FINAL

SASOL MINING
MIDDELBULT - BLOCK 8 - SHONDONI

EIAR (NEMA & MPRDA)

EIA PROCESS, PROJECT DESCRIPTION AND ENVIRONMENTAL BASE LINE

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VOLUME I OF IV

COMPILED FOR

SASOL MINING (Pty) Ltd
Middelbult – Block 8 – Shondoni

COMPILED BY

JMA Consulting (Pty) Ltd
Sustainable Environmental Solutions through Integrated Science and Engineering

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EXECUTIVE SUMMARY

Introduction

Sasol Mining operates a number of underground coal mines in the Secunda Area. Middelbult Colliery represents one of the underground mines and has been in operation since 1981. During its existence, Middelbult Colliery has gone through several expansions. Whilst some of the original shafts have already been closed and rehabilitated, new shafts have been developed to access coal within the larger Middelbult Reserves.

As part of this ongoing development to ensure access to exploitable reserves, Sasol Mining is now investigating options to replace the existing West Man and Materials Shaft with a new Man and Materials Shaft (Shondoni) in the Block 8 reserves in order to increase its reserve utilisation of the existing Middelbult operations (original Middelbult Reserves and Block 8 Reserves). At the same time the current mine lease area is also extended to now include the Block 8 Northern Reserves, the Springbokdraai Reserves and the Leeuwpan Reserves.

The proposed expansions require Environmental Authorisations. As part of this, potential environmental impacts must be assessed and the Environmental Management Plan (EMP) must be amended in terms of the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA). In order to achieve this, the current Environmental Impact Assessment (EIA) and Environmental Management Programme Report (EMPR) approved under the Minerals Act (Act 50 of 1991) must be amended.

Additionally, an Environmental Authorisation is required in terms of the National Environmental Management Act (NEMA) (Act 107 of 1998) for all listed activities related to the proposed expansion whilst an Integrated Water Use License Application (IWULA) is also required in terms of the National Water Act (NWA) (Act 36 of 1998) to authorize water uses related to the expansion. A waste license application to authorize the sewerage works at Shondoni in terms of the National Environmental Management Waste Act (NEMWA), Act 59 of 2008, is also required.

The proposed infrastructure expansion of the Middelbult operations, comprise one additional man and material shaft complex (Shondoni Shaft) with associated infrastructure in the Block 8 Reserves and a new overland conveyor to convey the coal to an existing conveyor in the south which will transport the coal to the Sasol Mining central coal stockpile area (Sasol Coal Supply or SCS), and of course the underground workings for the additional reserve blocks (Block 8 Northern Reserves, the Springbokdraai Reserves and the Leeuwpan Reserves).

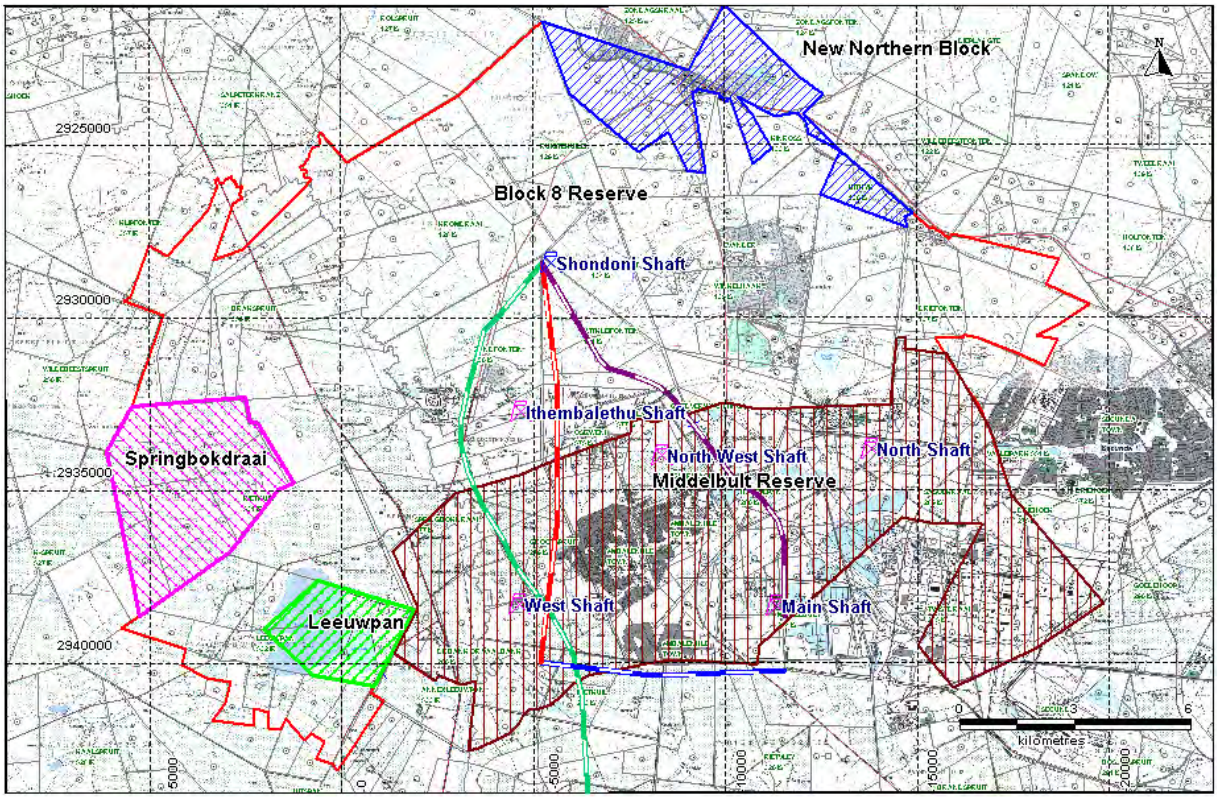
The proposed future mining activities will be conducted by means of underground mining operations, utilising the bord-and- pillar and high extraction methods to extract coal from the No.4 and No.2 Coal Seams. It is anticipated that approximately 8.5 to 9.5 million tons of coal per year will be mined. The increased utilisation of coal reserves will mean that Middelbult (Block 8) will continue mining (current schedule) for an additional 3 to 4 years. The long-term plan for Middelbult-Shondoni is to maximise its life thereby ensuring optimal coal reserve utilisation.

Since its inception in 1981, Middelbult Colliery has applied for, and has obtained approval for an EMPR (applied in 2001) as well as an EMPR Addendum (applied in 2003 for Block 8) in terms of the provisions of the old Minerals Act.

The intention of this current EMPR Addendum and EIA/EMP is to combine all the previous work done at Middelbult Colliery into one single integrated document which will represent the overall comprehensive Environmental Impact Assessment and Environmental Management Plan for Middelbult Colliery, including all new, as well as historic Shafts, Conveyors and Mining Operations, but now in compliance with the requirements of both the MPRDA as well as NEMA.

However, a clear distinction will be made in the report to separate all activities already authorized and new activities for which authorization are currently sought.

The Figure shown below, puts the project into an authorization time line perspective. The current Middelbult-Block 8 mine lease boundary is indicated with the **red** line.



Middelbult-Block 8-Shondoni Project Area

The area highlighted with **brown vertical lines**, represents the original Middelbult Colliery area for which an EMPR was submitted to the DME **in 2001 and which was approved in 2002**. The approval included the highlighted Underground Mining Area (both the No.2 Seam and the No. 4 Seam), the four shafts, Main Shaft, North Shaft, West Shaft and North-West Shaft, as well as the Coal Conveyor from the Main Shaft to the Sasol Central Coal Stockpile Area. Both North Shaft as well as North West Shaft have been decommissioned and closed and are not active any longer.

The area within the **red line** and which is not highlighted, represents the Block 8 EMPR Addendum which was submitted **in 2003 and approved in 2004**. This approval includes the Underground Mining on the No.2 Seam and the No.4 Seam within this area, as well as the Ithembalethu Shaft and Satelite Ventilation Shaft.

The **current application** therefore relates to the additional man and material shaft indicated as Shondoni Shaft and its associated infrastructure, the **green** coal conveyor belt from the Shondoni Shaft towards the south where it joins up with an existing conveyor belt, as well as the Underground Mining on the No.2 Seam and No.4 Seam for the areas highlighted in **green** (Leeuwpan Reserves), **magenta** (Springbokdraai Reserves) and **blue** (New Northern Block Reserves).

Purpose of this Report

This document represents the Final **EIA Report** compiled in terms of the NEMA and MPRDA Regulations, and as such was compiled in strict accordance with the Regulations:

EIA Regulations GNR 385 – NEMA (107 of 1998)

Environmental Impact Assessment Report (EIAR)

32. (1) if a competent authority accepts a scoping report and advises the EAP in terms of regulation 31(1) (a) to proceed with the tasks contemplated in the plan of study for environmental impact assessment, the EAP must proceed with those tasks, including the public participation process for environmental impact assessment referred to in regulation 29(1)(i)(iv) and prepare an environmental impact assessment report in respect of the proposed activity.

(2) An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in regulation 36, and must include -

(a) details of-

(i) the EAP who compiled the report; and

(ii) the expertise of the EAP to carry out an environmental impact assessment;

(b) a detailed description of the proposed activity;

(c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is -

(i) a linear activity, a description of the route of the activity; or

(ii) an ocean-based activity, the coordinates where the activity is to be undertaken;

(d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;

(e) details of the public participation process conducted in terms of subregulation (1), including-

(i) steps undertaken in accordance with the plan of study;

(ii) a list of persons, organisations and organs of state that were registered as interested and affected parties;

(iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and

(iv) copies of any representations, objections and comments received from registered interested and affected parties;

(f) a description of the need and desirability of the proposed activity and identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;

(g) an indication of the methodology used in determining the significance of potential environmental impacts;

(h) a description and comparative assessment of all alternatives identified during the environmental impact assessment process; (i) a summary of the findings and recommendations of any specialist report or report on a specialised process;

(j) a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;

(k) an assessment of each identified potentially significant impact, including -

(i) cumulative impacts;

(ii) the nature of the impact;

(iii) the extent and duration of the impact;

(iv) the probability of the impact occurring;

(v) the degree to which the impact can be reversed;

(vi) the degree to which the impact may cause irreplaceable loss of resources; and

(vii) the degree to which the impact can be mitigated;

(l) a description of any assumptions, uncertainties and gaps in knowledge;

(m) an opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;

(n) an environmental impact statement which contains -

(i) a summary of the key findings of the environmental impact assessment; and

(ii) comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;

(o) a draft environmental management plan that complies with regulation 34;

(p) copies of any specialist reports and reports on specialized processes complying with regulation 33; and

(q) any specific information that may be required by the competent authority.

MPRDA Regulations GNR 527 – MPRDA (28 of 2002)

50. Contents of Environmental Impact Assessment Report

The contents of an environmental impact assessment report must include the following:

(a) An assessment of the environment likely to be affected by the proposed mining operation, including cumulative environmental impacts;

(b) *an assessment of the environment likely to be affected by the identified alternative land use or developments, including cumulative environmental impacts;*

(c) *an assessment of the nature, extent, duration, probability and significance of the identified potential environmental, social and cultural impacts of the proposed mining operation, including the cumulative environmental impacts;*

(d) *a comparative assessment of the identified land use and development alternatives and their potential environmental, social and cultural impacts;*

(e) *determine the appropriate mitigatory measures for each significant impact of the proposed mining operation;*

(f) *details of the engagement process of interested and affected persons followed during the course of the assessment and an indication of how the issues raised by interested and affected persons have been addressed;*

(g) *identify knowledge gaps and report on the adequacy of predictive methods, underlying assumptions and uncertainties encountered in compiling the required information;*

(h) *description of the arrangements for monitoring and management of environmental impacts; and*

(i) *inclusion of technical and supporting information as appendices, if any.*

51. ***Environmental Management Programme***

An environmental management programme contemplated in section 39(1) of the Act must include the following:

(a) *A description of the environmental objectives and specific goals for-*

(i) *mine closure;*

(ii) *the management of identified environmental impacts emanating from the proposed mining operation;*

(iii) *the socio-economic conditions as identified in the social and labour plan; and*

(iv) *historical and cultural aspects, if applicable;*

(b) *an outline of the implementation programme which must include -*

(i) *a description of the appropriate technical and management options chosen for each environmental impact, socio-economic condition and historical and cultural aspects for each phase of the mining operation;*

(ii) *action plans to achieve the objectives and specific goals contemplated in paragraph (a) which must include a time schedule of actions to be undertaken to implement mitigatory measures for the prevention, management and remediation of each environmental impact, socio-economic condition and historical and cultural aspects for each phase of the mining operation;*

(iii) *procedures for environmental related emergencies and remediation;*

(iv) *planned monitoring and environmental management programme performance assessment;*

(v) *financial provision in relation to the execution of the environmental management programme which must include-*

(aa) *the determination of the quantum of the financial provision contemplated in regulation 54; and*

(bb) *details of the method providing for financial provision contemplated in regulation 53;*

(vi) *an environmental awareness plan contemplated in section 39(3)(c) of the Act;*

(vii) *all supporting information and specialist reports that must be attached as appendices to the environmental management programme; and*

(viii) *an undertaking by the applicant to comply with the provisions of the Act and regulations thereto.*

52. Environmental Management Plan

(1) *An applicant who's application for a prospecting right or mining permit was accepted in terms of the Act, must submit an environmental management plan at the office of the Regional Manager in whose region the application was lodged within 60 days from the date of notification by the Regional Manager.*

(2) *An environmental management plan, must substantially be in the standard format provided by the Department and must contain-*

(a) *a description of the environment likely to be affected by the proposed prospecting or mining operation;*

(b) *an assessment of the potential impacts of the proposed prospecting or mining operation on the environment, socio-economic conditions and cultural heritage, if any;*

(c) *a summary of the assessment of the significance of the potential impacts, and the proposed mitigation and management measures to minimise adverse impacts and benefits;*

(d) *financial provision which must include-*

(i) *the determination of the quantum of the financial provision contemplated in regulation 54; and*

(ii) *details of the method providing for the financial provision contemplated in regulation 53;*

(e) *planned monitoring and performance assessment of the environmental management plan;*

(f) *closure and environmental objectives;*

(g) *a record of the public participation undertaken and the results thereof; and*

(h) *an undertaking by the applicant regarding the execution of the environmental management plan.*

Report Content

In fulfilment of the regulations, this EIA Report contains the following information:

- Chapter 1 gives an **Introduction** to the project.
- Chapter 2 gives a detailed **Description of the EIA Process** as required by the relevant legislation (NEMA) and also gives details of the **Environmental Assessment Practitioner** and the **Project Team** appointed to undertake the EIA.
- Chapter 3 deals with the **Public Participation Programme** followed during the Scoping an EIA Process.
- Chapter 4 discusses the overall **Project Description** and gives details on the Project Enviro-Legal Framework, Project Applicant, Project Location and Relevant Authorities, Properties Affected, Project Resource Attributes, Project Motivation, followed by a detailed Project Description for the Construction Phase, Operational Phase, Decommissioning and Closure Phase, as well as the Post Closure Phase. The chapter also deals with the identification and consideration of **Project Alternatives**.
- Chapter 5 describes the **Current Environment** that could be impacted on by the proposed activities. This description contains a high level of detail as comprehensive base line studies were conducted for the project area since 2003 in support of previous EMPR Addendums for the mine.
- Chapter 6 deals with the **Environmental Impact Assessment**. It contains sections on Impact Assessment Methodology, Constraints and Limitations of the Impact Assessment, Identification of Impacting Activities for all the Life Cycle Phases culminating in an Aspects and Impacts Register as well as a description of the how the Impacts were Assessed by the different specialists in their respective studies. It concludes with a section containing the Impact Significance Assessment Summary Tables and finally deals with a discussion on Cumulative Impacts.
- Chapter 7 gives a detailed description of the **Proposed Environmental Management Measures**. It deals extensively with Proposed Management Objectives, Proposed Management Measures and concludes with a section containing the Environmental Management Measure Summary Tables.
- Chapter 8 deals extensively with **Proposed Environmental Monitoring**.
- Chapter 9 contains an **Environmental Impact Statement** by the EAP.
- Chapter 10 represents the **Professional Opinion** of the EAP in terms of whether the activity should be authorized and also lists specific conditions proposed for inclusion in the ROD.
- Chapter 11 contains a full **Reference** list of all specialist studies and supporting documentation.

The **Draft EIAR** was made available to the I&AP's for review and comment for a 30 day period from 15 November 2010 till 14 December 2010. All comments received, have been documented, answered/attended to and reported on in the formal comments register, which forms part of the Public Participation Programme Report attached as APPENDIX 3(A) in VOLUME IV of this submission. The **Draft EIAR** has been updated with these comments and responses, and which is now submitted as the **Final EIAR** to the relevant competent authorities for consideration and approval.

Following the NEMA and MPRDA EIA Processes

With effect from 3 July 2006, the listed activities and authorisation process promulgated in terms of the National Environmental Management Act 107 of 1998 (NEMA), commenced (**save for those listed activities in respect of mining which will commence at a date to be published**) and the relevant notices promulgated in terms of the Environment Conservation Act (ECA) (Act 73 of 1989) pertaining to identified activities and the Environmental Impact Assessment (EIA) Regulations have been repealed.

Section 24 of the NEMA, headed "Environmental Authorisations" sets out the provisions which are to give effect to the general objectives of Integrated Environmental Management (IEM). In terms of section 24(1), the potential consequences for or impacts on the environment of *inter alia* listed activities must be considered, investigated, assessed, and reported on to the competent authority and/or the Minister of Mineral Resources, except in respect of those activities that may commence without having to obtain an environmental authorisation in terms of the NEMA.

Accordingly, the listed activities have been promulgated in two different government notices, namely Government Notice R. 386 in Government Gazette No. 28753 of April 2006 (GNR 386), which identifies those activities for which a Basic Assessment must be undertaken in accordance with the procedure set out in regulation 22 to 26 of GNR 385, and Government Notice R. 387 in Government Gazette No. 28753 of 21 April 2006 (GNR 387), which identifies those activities for which a Scoping and Environmental Impact Assessment must be undertaken in accordance with the procedure set out in regulations 27 to 36 of GN R. 385.

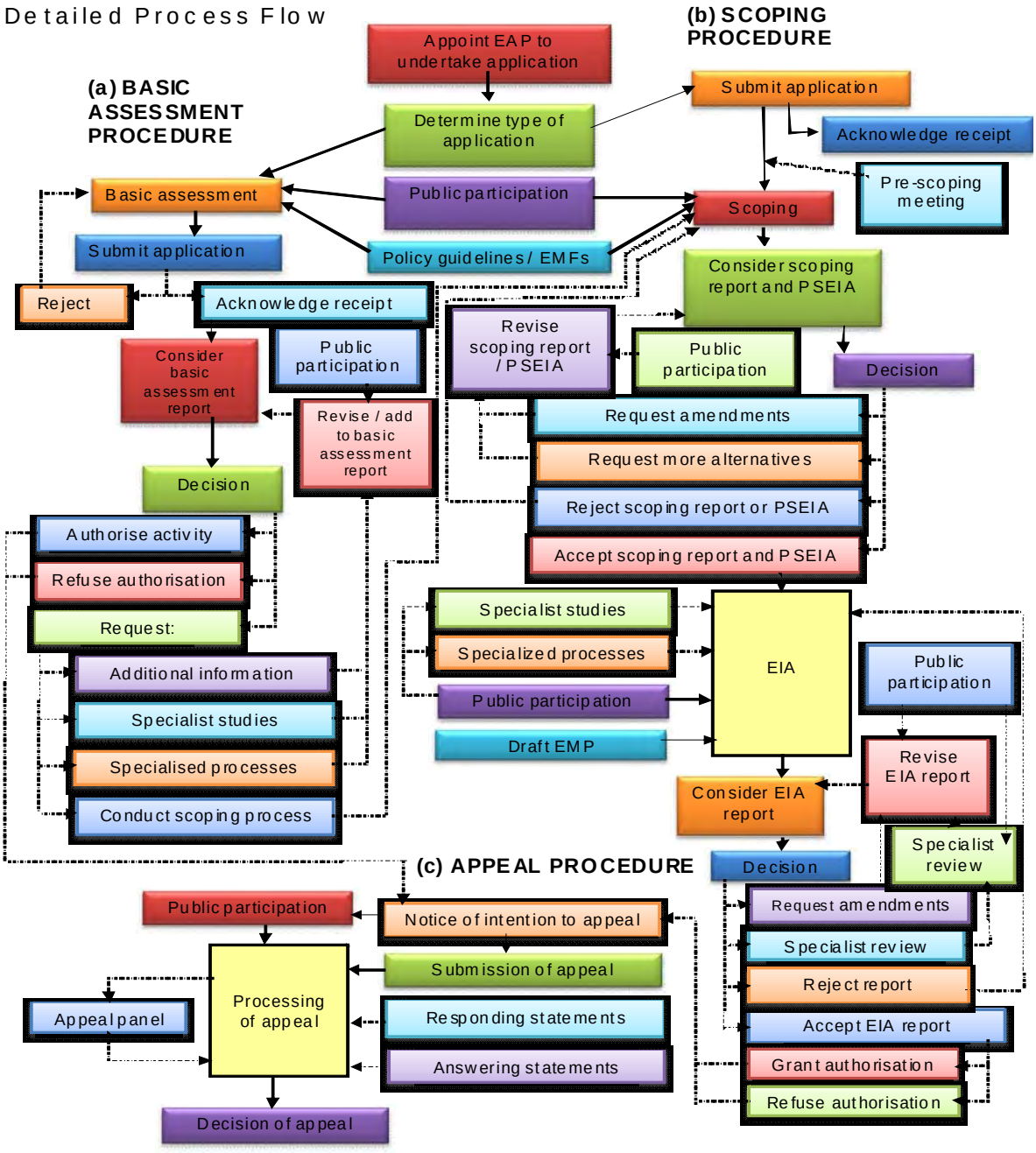
The Schedules to both GNR 386 and GNR 387 set out those activities that have been identified in terms of section 24(2)(a) and (d) of the NEMA which may not commence without environmental authorisation from the competent authority and for which the investigation, assessment and communication of potential impacts of the activities must follow the procedure described in regulation 22 to 26 of the regulations in respect of those activities that require a "Basic Assessment" or in terms of Regulation 27 to 36 of the regulations in respect of those activities that require "Scoping and Environmental Impact Assessment".

This application for Middelbult Shondoni is an application *inter alia* in terms of section 24 of the NEMA referred to above, read with GNR 385 and in particular the application for **Scoping and Environmental Impact Assessment** described in regulations 27 to 36. Various listed activities in both GNR 386 and GNR 387 will be undertaken in order to give effect to the project and these have been identified and listed in the application that will be submitted to the Department of Economic Development, Environment, and Tourism (DEDET).

However, in view of the fact that listed activities related to mining have not yet become part of the application to DEDET, these activities must be authorized by DMR in terms of the provisions of the MPRDA and the MPRDA Regulations GNR 527, which similarly also requires both the Scoping and EIA processes.

The diagram below, illustrates th e processes for both a Basic Assessm ent, and a Scoping and Environmental Impact Assessment. As described in Section 2.1 of the EIAR, various listed activities in both GNR 386 and GNR 387 have been identified for the Middelbult Shondoni Project and will be inc orporated in to one Scoping and Environm ental Im pact Assessm ent Process for this project.

However, the sam e EIA process will also be f ollowed to g ive com pliance with the requirements of the MP RDA Regulations, save that a form al application does not have to be lodged with DMR.



Combined NEMA and MPRDA EIA Process Flow Diagram

Details of and Declaration by the EAP

The EIA and associated EMP for this project was compiled by fully qualified and duly registered Professional Scientists and Engineers.

The duly appointed **EAP for the Project is JMA Consulting (Pty) Ltd**. JMA Consulting has in-house qualified experts in a number of specialist environmental disciplines. For the remainder JMA sub-contracted the services of the following Professional Consultancies and Certified Laboratories for specialist inputs into the project:

Sub-Consultancies
Dr Julius CC Pistorius Archaeological and Heritage Management Consultant
Acusolv Acoustic Consulting Engineers
Geostratum CC
Jones & Wagener (Pty) Ltd
Wetland Consulting Services
Earth Science Solutions
BKS Group (Pty) Ltd.

Laboratories
Yanka Laboratories

Details of Project Consultancy

Project Consultancy:	JMA Consulting (Pty) Ltd
Company Registration:	2005/039663/07
Professional Affiliations:	South African Council for Natural Scientific Professions
Contact Person:	Mr Jasper Müller (Pr.Sci.Nat.)
Physical Address:	15 Vickers Street DELMAS 2210
Postal Address:	P O Box 883 DELMAS 2210
Telephone no:	+27 13 665 1788
Fax no:	+27 13 665 2364
E-mail:	jasper@jmaconsult.co.za

The Principal Environmental Assessment Practitioner on the Middelbult-Shondoni project is Mr Jasper L Müller (Pr.Sci.Nat.). Jasper Müller holds a M.Sc. (cum laude) in Geohydrology from the University of the Free State and has been active as an earth scientist and environmental scientist since 1986. He has, since 1993, been involved in the compilation of more than 200 EMPR's, EIA's, EMP's and IWWM P's, and holds SACNASP registrations as both Earth Scientist and Environmental Scientist.

Jasper Müller was responsible for the overall project and specifically for EIA Process and Time Line Management, Project Technical Management (commissioning of specialist studies), and finally all the EIA/EMP Report Compilation including the full integration of all specialist study findings into the EIA/EMP.

The Declaration of Independence signed by the EAP is contained in section 2.2.3 of the EIAR.

Public Participation Program

A comprehensive Public Participation Program was conducted for the Middelbult Shondoni Project. The program was conducted by JMA Consulting in collaboration with BKS. A full Public Participation Report for this project is attached as APPENDIX 3 (A) in VOLUME IV of this EIAR.

The public participation process:

- provided an opportunity for Interested and Affected Parties (I&APs) to obtain clear, accurate and comprehensible information about the proposed activity, its alternatives or the decision and the environmental impacts thereof;
- provided I&APs with an opportunity to indicate their viewpoints, issues and concerns regarding the activity, alternatives and/or the decision;
- provided I&APs with the opportunity of suggesting ways of avoiding, reducing or mitigating negative impacts of an activity and for enhancing positive impacts;
- enabled the applicant to incorporate the needs, preferences and values of affected parties into the activity;
- provided opportunities to avoid and resolve disputes and reconcile conflicting interests; and
- enhanced transparency and accountability in decision-making.

The public participation for this project commenced during the pre-application phase and ran continuously through all the EIA phases.

Project Title

Project Title
Sasol Mining – Middelbult Shondoni : EMPR Addendum, EIA, IWULA and WLA

Considered Acts and Regulations

A review of the specific project components has indicated the following Environmental Acts and Regulations to be directly applicable for the Environmental Authorisations required for this project. An expanded, generic, Enviro-Legal Framework, as applicable to the overall EIA/EMPR/IWULA/WLA project is attached as APPENDIX 4.2(A) – VOLUME IV.

Directly Applicable Environmental Legislation	
1.	National Environmental Management Act No. 107 of 1998 (NEMA)
2.	Mineral and Petroleum Resources Development Act No. 28 of 2002 (MPRDA)
3.	National Water Act No. 36 of 1998 (NWA)
4.	National Environmental Management: Waste Act No. 59 of 2008 (NEMWA)

The following regulations published in term s of these Acts, have pertinent bearing on inputs into this report:

Applicable Regulations	
NEMA	
1.	GNR 385 of 21 April 2006 – EIA Regulations
2.	GNR 386 of 21 April 2006 – Basic Assessment Listed Activities
3.	GNR 387 of 21 April 2006 – Scoping and EIA Listed Activities
MPRDA	
1.	GNR 527 of 23 April 2005 – Mineral and Petroleum Resources Development Regulations
NWA	
1.	GNR 3208 of 29 August 1969: Regional Standards for Industrial Effluents
2.	GN 991 of 18 May 1984: Requirements for the Purification of Waste Water or Effluent
3.	GNR 2834 of 27 December 1985: Regulations in terms of section 26, read in conjunction with section 12A of the Water Act, 1956 (Act 54 of 1956), for the erection, enlargement, operation and registration of water care works
4.	GNR 1560 of 25 July 1986: Regulations in terms of section 9C(6) of the Water Act, 1956, relating to dams with a safety risk
5.	GNR 704 of 4 June 1999 – Regulations on use of water for mining and related activities aimed at the protection of water resources
6.	GNR 1352 of 12 November 1999 – Regulations requiring that a water use be registered
7.	GNR 212 of 10 March 2000 – Request to register a water use
8.	GN 470 of 12 May 2000 – Request to register a water use
9.	GNR 398 of 26 March 2004 – General authorisations in terms of Section 39 of the National Water Act
10.	GNR 399 of 26 March 2004 – General authorisations in terms of Section 39 of the National Water Act
11.	GNR 519 of 6 May 2009 – Notice to Register a Water Use in terms of NWA
NEMWA	
1.	GNR 718 of 3 July 2009: List of Waste Management Activities that have, or are likely to have a Detrimental Effect on the Environment.

Existing Authorizations

All existing Environm ental Authorisations for Middelbult Mine are listed below, whilst copies of the relevant ROD's, Perm its and Licences are attached in APPENDIX 4.2(B) – VOLUME IV.

Sequential Number	Existing Environmental Authorisations
1	Approved EMPR for Secunda Collieries (Middelbult Colliery) - 2002
2	Approved EMPR Addendum for Middelbult Block 8 - 2003
3	General Authorisations - pending
4	GN 704 Exemptions – pending
5	Registered Existing Water Uses – pending
6	Approval of Integrated Water Use License - pending

Environmental Authorizations Required for this Project

Based on the Enviro-Legal framework and having regard to the relevant and specific project attributes, a number of authorisations will be applied for during the course of the Environmental Authorisation Phase of this Project.

National Environmental Management Act, Act No. 107 of 1998		
Section 24	**Environmental Authorisation Application**	
GNR 386		
Activity 1(c)	The construction of facilities or infrastructure, including associated structures of infrastructure, for – the storage of 250 tons or more but less than 100 000 tons of coal	Coal throw out stockpile area at Shondoni Shaft
Activity 1(m)	The construction of facilities or infrastructure, including associated structures of infrastructure, for – any purpose in the 1:10 year flood line of a river or stream, or within 32 *m* from the bank of the river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including – (i) canals; (ii) channels; (iii) bridges; (iv) dams; (v) weirs	Conveyor Pedestal for crossing of Trichardt Spruit
Activity 1(n)	The construction of facilities or infrastructure, including associated structures of infrastructure, for – the off-stream storage of water, including dams and reservoirs, with a capacity of 5 0 00 0 cubic metres or more, unless such storage falls within the ambit of the activity listed in item 6 of Government Notice No. R. 387 of 2006	Service Water Dams and Storm Water Pollution Control Dam at Shondoni Shaft Complex
Activity 4	The dredging, excavation, infilling, removal or moving of soil, sand or rock exceeding 5 cubic metres from a river, tidal lagoon, tidal river, lake, in-stream dam, floodplain or wetland.	Excavation for Coal Conveyor Pedestal for crossing of Trichardt Spruit
Activity 7	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic metres but less than 1 000 cubic metres at any one location or site.	Diesel Fuel Storage Tanks at Shondoni Shaft Complex
Activity 12	The transformation or removal of indigenous vegetation of 3 hectares or more or of any size where the transformation or removal would occur within a critically endangered or an endangered ecosystem listed in terms of it section 52 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	Removal of Indigenous Vegetation during Site Clearance for Construction of Shondoni Shaft Complex and related Infrastructure
Activity 13	The abstraction of groundwater at a volume where any general authorisation issued in terms of the National Water Act, 1998 (Act No. 36 of 1998) will be exceeded.	Removal of water found in the underground workings on the No.4 Seam and the No.2 Seam workings to facilitate the efficient continuation of mining and for the safety of people
Activity 14	The construction of masts of any material or type and of any height, including those used for telecommunication broadcasting and radio transmission.	Tetra Radio System that will be installed above ground at the Shaft Complex Area.
Activity 15	The construction of a road that is wider than 4 metres or that has a reserve wider than 6 metres, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 metres long.	Access Road to Shondoni Shaft Complex from Tar road R547
GNR 387		
Activity 1 (l)	The construction of facilities or infrastructure, including associated structures or infrastructure, for – the transmission and distribution of above ground electricity with a capacity of 120 kilovolts or more.	Double Circuit 132 kV Overhead Poweline from Eskom Supply Point (SOL B) to Shondoni Mine Transmission Feeder Bays.

Activity 1(j)	The construction of facilities or infrastructure, including associated structures or infrastructure, for – the bulk transportation of dangerous goods using pipelines, funiculars or conveyors with a throughput capacity of 50 tons or 50 cubic metres or more per day.	Coal Con veyor fr om Shondoni Shaft to Middelbult Main Shaft (Sasol Coal Supply, the central coal stockpile area).
Activity 2	Any develop ment activity, including associated structures and infrastructure, where the total area of the developed a rea is, or is intend ed to be, 20 hectares or more.	Developed ar ea including sha ft sur face infrastructure and conveyor route.

Mineral and Petroleum Resources Development Act, Act No. 28 of 2002		
MPRDA Section 44	**Mining Right Application**	

National Water Act, Act No. 36 of 1998		
NWA Section 40	**Integrated Water Use License Application (Includes Registrations)**	
Section 21(a)	Taking water from a water resource	Service water used underground sourced from underground water make (21(j))
Section 21(c)	Impeding or diverting the flow of water in a watercourse	Coal conveyor from Shondoni Shaft to Central Coal Stockpile Area
Section 21(f)	Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit	Shondoni Shaft Sewerage Plant
Section 21(g)	Disposing of waste in a manner which may detrimentally impact on a water resource	Shondoni Shaft Service Water Dams, Storm Water PCD and Shondoni Shaft Berms Walls
Section 21(i)	Altering the bed, banks, course or characteristics of a watercourse	Coal Conveyor from Shondoni Shaft to Central Coal Stockpile Area. Possible stream diversion at Shaft Locality for Incline Shaft.
Section 21(j)	Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people	Removing Mine Water Make from the No.4 Seam and No.2 Seam Underground Works
NWA Section 39	**General Authorisations**	
Section 21(c)	To be applied for in consultation with DWAF	
Section 21(f)	To be applied for in consultation with DWAF	
Section 21(g)	To be applied for in consultation with DWAF	
Section 21(i)	To be applied for in consultation with DWAF	
GNR 1352	**Water Use Registration**	
	Included in Water Use License Application and/or General Authorisation	
GNR 740 (R 3)	**Exemptions from GNR 704**	
Regulation 4 (a) (Restrictions On Locality)	No person in control of a mine or activity may 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 water course or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on water-logged ground, or on ground likely to become water-logged, undermined, unstable or cracked.	Shondoni Shaft Complex
Regulation 4 (b) (Restrictions On Locality)	No person in control of a mine or activity may, except in relation to a matter contemplated in Regulation 10 (winning sand and alluvial minerals), carry on any underground or opencast mining, prospecting or any other operation or activity under or within the 1:50 year flood line or within a horizontal distance of 100 metres from any water course or estuary, whichever is the greatest.	Entire Middelbult, Block 8, Springbokdraai and Leeuwpan Reserve
Regulation 4 (d) (Restrictions On Locality)	No person in control of a mine or activity may 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 water course or estuary.	Shondoni Shaft Complex and Coal Conveyor from Shondoni Shaft to Middelbult Main Shaft (Sasol Coal Supply, the central coal stockpile area).

Regulation 5 (Restrictions On Use of Material)	No person in control of a mine or activity may use any residue or substance which causes or is likely to cause pollution of a water resource for the construction of any dam or other impoundment or any embankment, road or railway, or for any other purpose which is likely to cause pollution of a water resource.	Use of overburden material excavated from Shondoni Shafts for construction of berms around Shondoni Shaft Complex

National Environmental Management Waste Act, Act No. 59 of 2009		
NEMWA Section 45	**Application for Waste Management Licences**	
Category B (7)	Treatment of sewage with an annual throughput capacity of 15 000 cubic metres or more.	Shondoni Shaft Sewerage Plant.

Project Proponent/Applicant

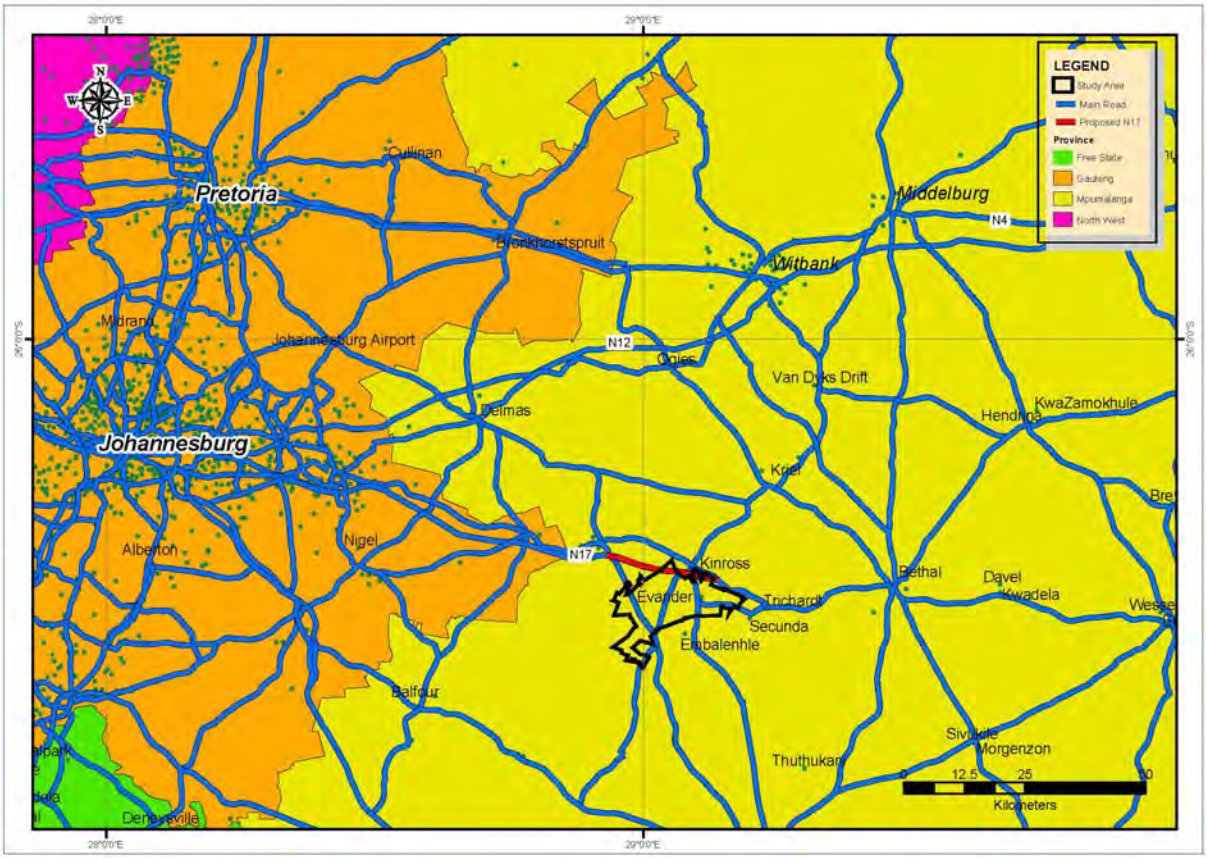
Project Applicant:	Sasol Mining (Pty) Ltd
	Private Bag X 1015
	Secunda
	2302
Mineral Rights Holder:	Sasol Mining (Pty) Ltd
	Private Bag X 1015
	Secunda
	2302
Mining Authorisation Holder:	Sasol Mining (Pty) Ltd
	Private Bag X 1015
	Secunda
	2302
Mine:	Middelbult (Block 8) Shondoni Project
	Private Bag X 1015
	Secunda
	2302
Mine Manager:	Mr Gerrit van der Westhuyzen
Contact Person:	Dr Gail Nussey
Telephone no:	+ 27 17 614 2207
Fax no:	+ 27 11 522 9272
E-mail:	gail.nussey@sasol.com

Regional Setting

Middelbult Colliery, in cluding the Shondoni Shaft, in the Block 8 Reserves of M iddelbult Colliery, is located in the Mpumalanga Province of South Africa. The site locality, in relation to neighbouring towns/cities, is given in the Table below.

Locality of Middelbult Colliery in relation to nearest Towns/Cities

Town	Distance from Site (km)	Direction from Site
eMbalenhle	**7**	**South**
Kinross	**7**	**North**
Evander	**5**	**East**
Secunda	**15**	**East**
Trichardt	**19**	**East**



Regional Setting of the Project

Relevant Authorities

Department of Water and Environmental Affairs (DWEA)

National Department:	Department of Water Affairs (Head Office)
Directorate/Designation:	PWPCO
Contact Person:	Nemalili Khathutshelo
Postal Address:	Private Bag X 313, Pretoria, 0001
Telephone no:	+ 27 12 336 8659
Fax no:	+ 27 12 323 0321
Cellular Phone:	+ 27 79 871 3657
E-mail:	nemalilik@dwaf.gov.za

Department of Water Affairs (DWA)

Regional Department:	Gauteng Region
Directorate/Designation:	SWPCO
Contact Person:	Joyce Lekoane
Postal Address:	Private bag X 995, Pretoria, 0001
Telephone no:	+ 27 12 392 1381
Fax no:	+ 27 12 392 1359
Cellular Phone:	+ 27 82 600 5669
E-mail:	lekoanej@dwaf.gov.za
Water Management Area	Waterval Catchment

Department of Mineral Resources (DMR)

Regional Department:	Mpumalanga Region
Directorate/Designation:	Witbank Office
Contact Person:	Bethuel Matodzi
Postal Address:	Private Bag X 7279, Witbank, 1035
Telephone no:	+ 27 13 656 1448
Fax no:	+ 27 13 690 3288
Cellular Phone:	+ 27 82 621 3559
E-mail:	bethuel.matodzi@dme.gov.za

Department of Economic Development, Environment and Tourism

Regional Department:	Mpumalanga
Directorate/Designation:	Ermelo
Contact Person:	Surgeon Marebane
Postal Address:	P O Box 2777, Ermelo, 2350
Telephone no:	+ 27 17 819 1155
Fax no:	0 86 516 3658
Cellular Phone:	+ 27 72 408 3138
E-mail:	surgeon@environ1.agric.za

Department of Agriculture, Rural Development and Land Administration

Regional Department:	Mpumalanga
Directorate/Designation:	Nelspruit
Contact Person:	Love Shabane
Postal Address:	P O Box 8866, Nelspruit, 1200
Telephone no:	+ 27 13 755 1420
Fax no:	+ 27 13 755 1961
Cellular Phone:	+ 27 82 428 4480
E-mail:	loves@nda.agric.za

Mpumalanga Tourism & Parks Agency (MTPA)

Office:	Ermelo
Directorate/Designation:	Environmental Authorisations
Contact Person:	Vaino Prinsloo
Postal Address:	P O Box 1250, Groblersdal, 0470
Telephone no:	+ 27 17 819 5346
Fax no:	0 86 609 0238
Cellular Phone:	+ 27 82 468 5447
E-mail:	vaino@vodamail.co.za

District Municipality

District Authority:	Gert Sibande District Municipality
Designation:	Health & Social
Contact Person:	Mr D Hlanyane
Postal Address:	P O Box 550, Secunda, 2302
Telephone no:	+ 27 17 620 3000
Fax no:	+ 27 17 631 1607
Cellular Phone:	+ 27 82 904 0736
E-mail:	dan.hlanyane@gsibande.gov.za

Local Municipality

Local Authority:	Govan Mbeki Local Municipality
Designation:	HOD: Public Safety
Contact Person:	Mrs A Aphane
Postal Address:	Private Bag X 1017, Secunda, 2302
Telephone no:	+ 27 17 620 6000
Fax no:	+ 27 17 634 8019
E-mail:	kgomotso.a@govanmbeki.gov.za

Property Description/Land Owner/Zoning/Servitudes

A detailed property description for the entire Middelbult, Block-8, Leeuwpan, Springbokdraai and Block 8 Northern Reserve Area has been compiled and is described in detail in section 4.5 of the EIAR.

Project Resource Attributes

The geology of the area consists of mainly sedimentary and igneous strata of the Witwatersrand, Ventersdorp, and Transvaal Supergroups; as well as igneous rock from the Bushveld Complex, which suboutcrops along the sandstone/siltstone base of the Karoo Supergroup. The base of the Karoo consists of tillite overlain by sandstone and siltstone of the Pietermaritzburg Formation, which is in turn overlain by sediments from the Vryheid Formation. Between the upper sandstone\siltstone layers a number of coal seams have developed (C2, C3, C4L, C4U and No. C5 Coal Seams). The coal is of a low-grade bituminous quality occurring in horizontal seams.

Of the Coal Seams mentioned, only the No. C2 and the No. C4L Coal Seams are mineable within the Middelbult/Block-8/Leeuwpan/Springbokdraai/Block-8 Northern Reserves. Historic Mining at Middelbult Colliery, performed under previous existing authorizations, extracted primarily from the C4L Seam. Specifically for this authorization project, related to the Shondoni Shaft, both the No. C2 and the No. C4L Coal Seams will be mined. The average depth to the No. C4L Coal Seam is some 117 m below ground surface. The No. C2 occurs some 20 m – 30 m deeper. Mining depths to date varied and is estimated in future to vary in the new sections between 70 m to 160 m below surface.

The existing mineable coal reserves in the original Middelbult Mining Area (excluding Block 8, Leeuwpan, Springbokdraai and the Block 8 Northern Reserves) has largely been mined. The Block 8 reserve area, including Leeuwpan, Springbokdraai and Block 8 Northern Reserves) contains in excess of 370 million tons of Run of Mine (ROM - mineable) coal. The coal is of a low-grade bituminous quality. The mined and crushed coal will be brought to surface at Shondoni Shaft from where it will be transported by conveyor to link up with the southern Brandspruit Mine conveyor and then onto the stockpiles at the existing Sasol Coal Supply (SCS) area, from where it will be transported directly into the Sasol Synfuels Plant at Secunda.

The planned production rate for Middelbult Colliery from all shafts (including Shondoni) is estimated to be between 8.5 million and 9.5 million tons of ROM coal per year. The Shondoni Project will increase the Middelbult Colliery Life of Mine until the year 2041.

Project Motivation

Middelbult Colliery is a part of the well established Sasol Mining Group, which is legally authorized to mine coal from the Middelbult and Block 8 Reserves. Middelbult Block 8 holds an approved EMPR and EMPR Addendum and is in possession of the relevant required Mining Authorisations from DME (now DMR). The proposed Shondoni project relates primarily to the establishment of additional infrastructure (shaft complex, conveyor, powerline etc.) to optimally extract the already authorized reserves.

However, as part of this application, three additional reserve blocks, known as Block 8 Northern Reserves, Springbokdraai and Leeuwpan, will also be applied for.

The coal produced by Middelbult – Shondoni contributes a significant portion of the critically required feed into the Sasol Synfuels Plant at Secunda. The sustained maintenance of the coal mining production rates to source the SSF Plant is of the utmost importance. Sasol Synfuels in Secunda arguably represents one of the single most strategic industries in South Africa. Without quoting figures, it is obvious that its contribution to the supply of the national liquid petroleum, industrial chemical and agricultural chemical markets, to name but a few of the more obvious, is of national strategic significance.

The exiting Middelbult Mine has contributed to the South African GDP since the 1990's. The expansion of the Middelbult mining operations into the Block 8, Springbokdraai, Leeuwpan and Block 8 Northern Reserves will contribute significantly to the GDP. Estimates in 2003, puts a shaft development cost, similar to what is envisaged at Shondoni, at an estimated R 900 million. The annual expense budget estimated in 2003, puts annual expenditure during full production at some R 700 million per year.

Although none of the Middelbult Shondoni coal will be sold directly into the foreign markets, the indirect contribution to the South African Balance Sheet is obvious due to the significant contribution to the local economy via the Sasol Synfuels contribution to fuel and chemicals supply.

Socio-Economic Benefits

Middelbult - Block 8 - Shondoni), as part of the overall mining and industrial industry in the Govan Mbeki Municipal Area, contributes quite significantly to the socio-economic wellbeing of the region. Studies conducted in the area clearly show the dominant contribution of the mining and associated industrial sectors to the socio-economic fabric of the area. The influence of the mining and industrial sectors clearly manifest in aspects related to age distribution, employment, income and the provision of services and housing.

The number of people employed in the Govan Mbeki Municipality amounts to some 67 172 people (or 32 % of the total population). Not reflected in these figures is the amount of informal employment within the district. In a study conducted by DPR (2000), the number of people involved in the informal employment sector in the Highveld Ridge District was ±7 000.

Information available for the various sectors of the economy and the number of people employed in these sectors, indicate that mining accounts for the highest number of employees at 9,54% (20 018 people) followed by manufacturing at 4,35% (9 130 people). However, these figures only reflect the direct employment in these sectors and do not account for the peripheral employment created around these sectors.

The Middelbult - Block 8 - Shondoni workforce of 1600 employees represents some 8 % of the total mining sector workforce in the area.

Detailed Project Description

Although this current project represents an application for authorization of a mining activities related to the new Shondoni Shaft Complex for Middelbult Colliery, the description to follow will provide details for the entire Middelbult Colliery operation, including information contained in the previously approved EMPR (2002) and EMPR Addendum (2004) for the mine. The motivation for this is to support integrated environmental management between both the existing, as well as the proposed new operations, at Middelbult-Block 8-Shondoni.

The Middelbult - Block 8 Mine currently comprises of 5 authorized Shafts, of which two are already closed. Four of these shafts are located within the original Middelbult Reserve:

- **Main Shaft** – still operational
- **West Shaft** – still operational
- **North Shaft** – closed
- **North-West Shaft** – closed

The fifth shaft is:

- **iThemba lethu Shaft**

This shaft is located in the Block 8 Reserves, which was authorized with the Block 8 EMPR Addendum in 2004.

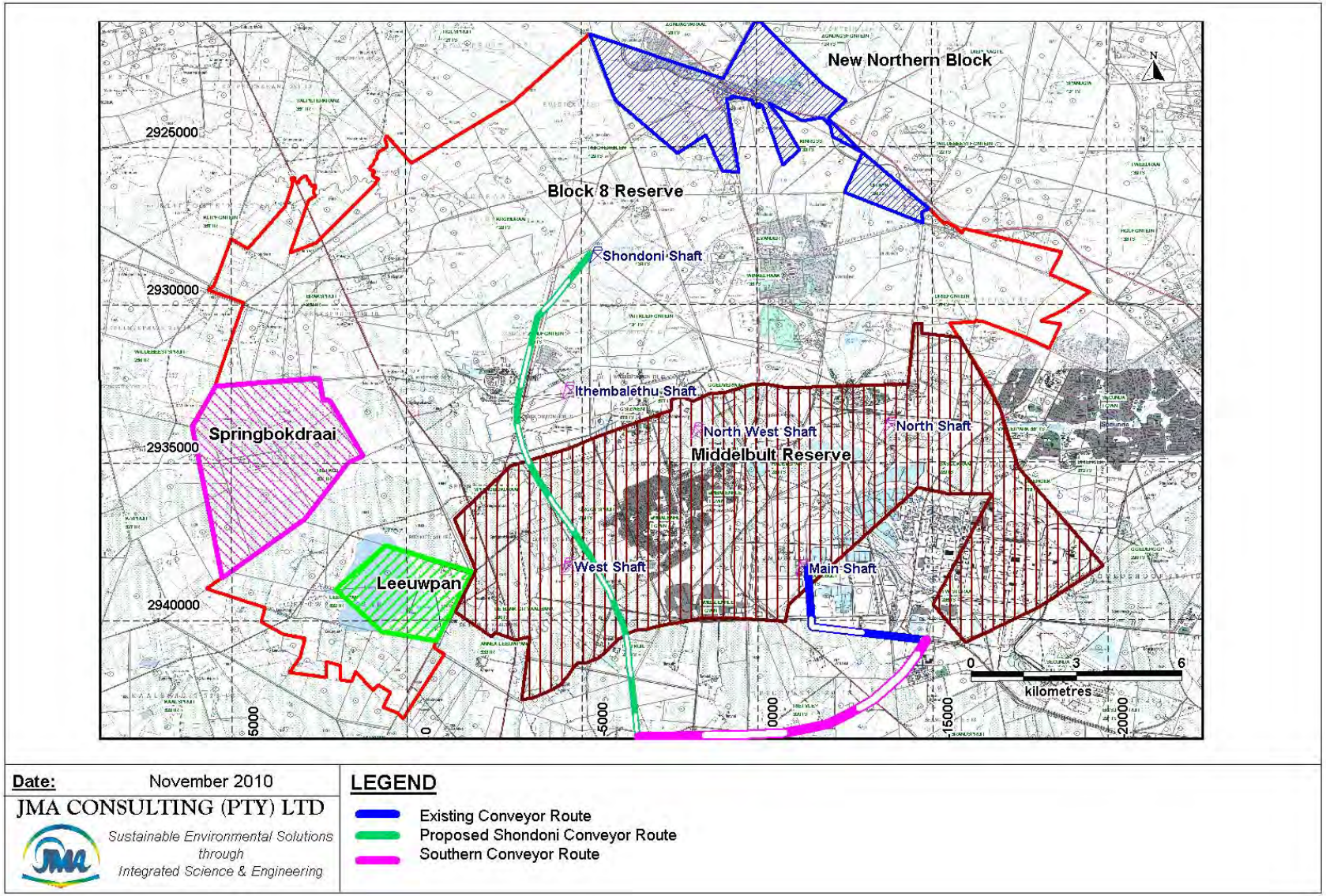
The current project comprises the development of the new **Shondoni Shaft** Complex in the Block 8 Reserves, the construction and commissioning of a conveyer belt system to transport the coal to link up with an existing Conveyor in the south, and then on to Sasol Coal Supply (SCS, the central coal stockpiles) and the associated development of underground bord and pillar and high extraction mining on the No.C4L and No. C2 Coal Seams.

The localities of the existing shafts, the locality of the proposed Shondoni Shaft, the delineations of the Middelbult Reserves, Block 8 Reserves, Block 8 Northern Reserves, Springbokdraai Reserves and the Leeuwpan Reserves, as well as the alignments of the existing Middelbult Conveyor and the proposed new Shondoni Conveyor, is shown on the Figure on the next page.

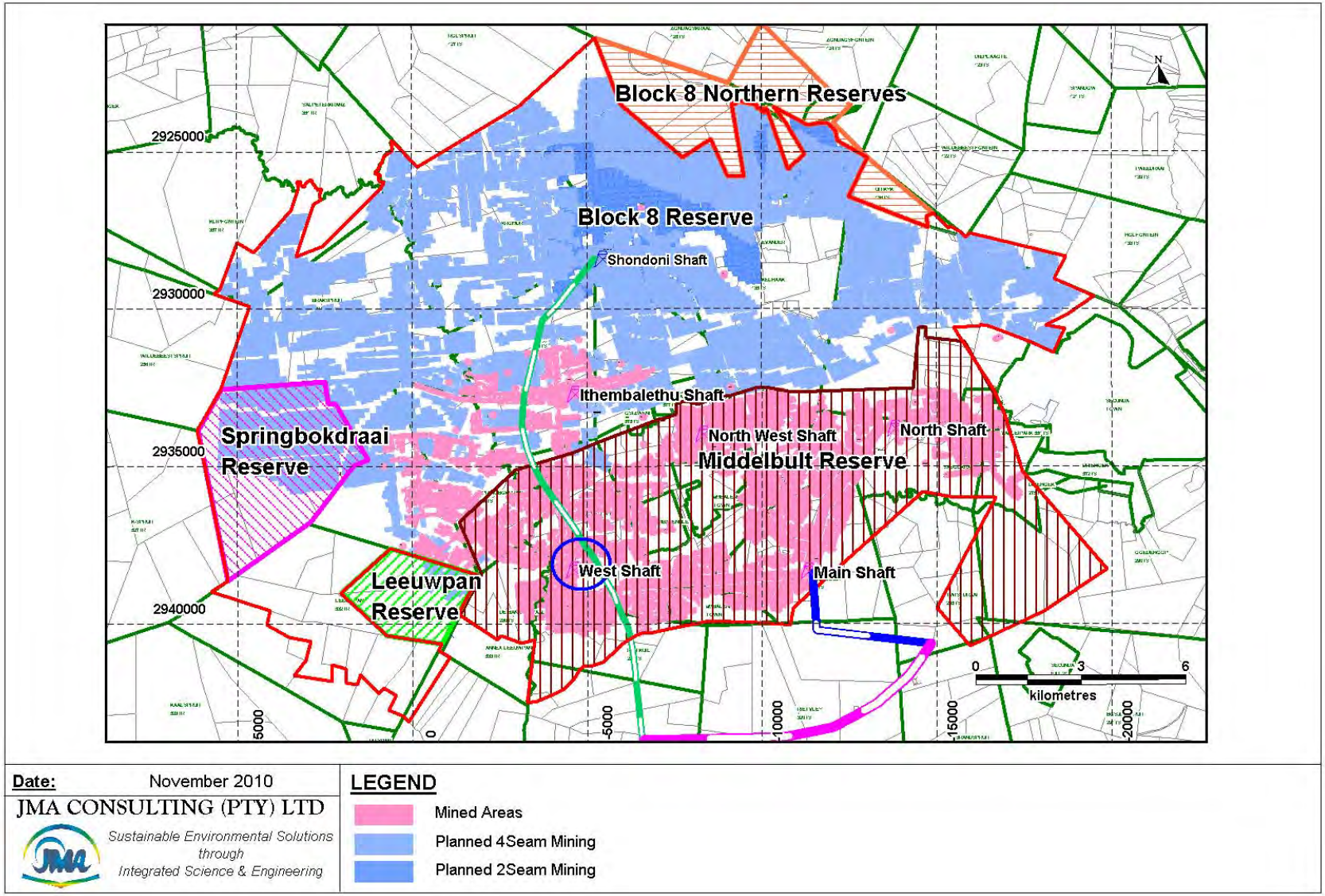
The historic mining on the No. C4L seam (red areas in Middelbult and Block 8 Reserves), as well as the proposed new mining on the No. C4L seam (blue areas in Block 8, Leeuwpan and Springbokdraai Reserves) are shown on the Figure after the Figure on the next page.

Full details related to all aspects of the existing, as well as proposed new activities, at Middelbult – Block 8 – Shondoni, are given in section 4.8 of the EIAR.

Detailed discussions are given for surface infrastructure, mining infrastructure, coal storage, coal, water and electricity conveyance, servitudes, pipelines and power lines, mineral processing, water management infrastructure, waste management facilities, water balances and salt balances.



The Middelbult-Block 8-Shondoni Surface Plan



The Middelbult-Block 8-Shondoni Underground Mining Plan (No. C4L and No. C2 Coal Seam)

Construction Phase Activity Description

Construction activities will be restricted to the Shaft Complex and its access route from the R547, as well as along the coal conveyor servitude. The construction phase will run for approximately three years and is scheduled to commence in 2011 with completion in 2013. The mine needs to be in production by 2014.

Construction will commence with site clearance and will primarily comprise civil and building construction works of the access road, the shaft complex buildings, water pollution control measures, service water dams, as well as the vertical people and materials shaft, the incline coal conveyance shaft and the vertical ventilation shaft. Activities will be restricted to within the different servitude areas for the access road, the shaft complex, and the conveyor route.

As indicated earlier blasting will occur during the vertical and incline shaft construction. The excavated materials from the shaft will be used to construct berms and embankments around and within the shaft complex. All construction sites will be fenced to regulate access during the construction period.

Of particular importance during the construction phase, are the potential for stream crossings by the coal conveyor system and possibility of one stream diversion that may be required. Depending on the selected conveyor route, a number of stream crossings may be required. At the incline shaft for the proposed shaft locality, a stream diversion may be required depending on the final design. Stream crossings and river diversions are authorized as NWA section 21 (c) and (i) water uses or General Authorisations.

Operational Phase Activity Description

The mine will go into production in 2014 and will have an expected life of approximately 27 years. The mine will operate on a 24 hour per day basis. During the operational phase most activities will occur underground. The two coal seams will be mined with continuous miners and therefore no routine mining related blasting will occur. However, when dolerite structures need to be penetrated to access the coal seams, limited underground blasting will occur from time to time.

The coal is cut at the mining faces, loaded automatically onto the shuttle cars from which it is loaded onto the conveyor system which takes the coal along the incline shaft to surface.

On surface the coal goes directly into the surface bunker from where it is transferred onto the overland conveyor which transports the ROM coal to Sasol Coal Supply. The surface coal bunker also has an emergency surface throw out area in the event that the conveyor system cannot handle the volume of coal as a result of maintenance. Surface activities at the shaft relate to general administration and management. Underground personnel access the mine through the vertical people and material shaft after preparing for shifts in the change houses, where they also wash and refresh at the end of shifts.

The shaft complex also handles all materials that need to go underground and has stores and workshops to cater for repairs that cannot be done underground. The ventilation shaft is also operated at the shaft complex and comprises the operation of extraction fans to drive the up cast ventilation system.

Apart from the operational activities, general water management and waste management is also done on surface at the shaft complex. Potable water, service water and storm water management infrastructure are located at the shaft and operated on an ongoing basis. Waste generated on surface is disposed in bins located in dedicated areas and removed by waste management contractors. Water make in the underground mining sections is largely managed underground and within a series of surface located PCD's. The portion which is required for service water purposes is pumped to surface and stored in specially constructed service water dams, and then gravitated back underground for use for mining and dust suppression.

Decommissioning and Closure Phase Activity Description

During decommissioning and closure, equipment will be removed and sold for re-use or disposed of as scrap. The buildings will be renovated for alternative use or be demolished. Access roads, if not used, will be scarified and re-vegetated. All plant will be sold to appropriate dealers and removed from the mine property. Electrical and water supplies in the plant area, if not used, will be terminated and made safe.

The shaft entrances will be sealed according to the requirements of the MPRDA. Overburden removed from the shaft originally will be returned to the hole and compacted. Usable soil will then be replaced and contoured to be free draining. Topsoil will be replaced over this material. Final soil remediation and re-vegetation of the site will be undertaken.

During decommissioning any cracks that resulted from surface subsidence in the mining area will be filled and subsided areas made free draining.

Water levels in the workings will start to recover once mining ceases. However, the relatively low percentage of pillar extraction planned (25% of the mining area) and the isolation of these areas from the rest of the mining is likely to result in favourable conditions for decant (i.e. decant of a good water quality) over most of the area. Of the predicted decant, some 60% is predicted to be from the areas of pillar extraction, with the balance from the areas of bord-and-pillar mining.

The high extraction compartments are expected to fill nearly three times faster than the bord-and-pillar compartments, and these are as may require water to be actively extracted and managed within 30 years of mine closure. Should the compartments remain separate as intended, this will delay the onset of decant from the areas mined by bord-and-pillar methods.

Various options remain to manage the pillar extraction compartments, including placing this water into the base of bord-and-pillar compartments (if this can be done without affecting stratification of these compartments) and/or management as part of the Synfuels Complex water balance. Options of moving water between compartments will be evaluated and submitted to the authorities if and when applicable. A commitment will be given to actively manage water from the high extraction compartments if required, as well as to monitor, reuse and treat (if necessary, but considered unlikely) the water in the bord-and-pillar areas.

Post Closure Phase Activity Description

It is envisaged that during the Post Closure Phase the surface infrastructure which has not been demolished will be used for alternative purposes. In the remainder of the mining area it is expected that the current pre-mining land uses will be able to continue.

The only significant post closure residual impact that could occur, relates to possible decant of contaminated water from the underground m ine if proper m anagement is not followed. Various options to m anage this residual impact exist. The selected m ethodology and technology will be formalized during application for Closure.

Project Alternatives

The consideration of realistic pro ject alternatives, with inclus ion of the "No-Go" alternative, is a minimum requirement of the EIA regulations.

During the scoping phase of the project, the following list of alternatives to be considered was submitted for conside ration to th e I&AP's as well as the au thorities. The lis t was com piled after due c onsideration by the ap plicant, the consulting engineers and the environm ental scientists taking due cognizance of the nature a nd extent of the proposed project. T he list is deemed to represent realistic aspects for the specific project.

- The Mining Method
- Location of Shafts
- The Mining Plan
- Transport Methods for Water, Electricity and Coal
- Transport Routes for Water, Electricity and Coal
- Surface Handling of Coal
- Domestic and Industrial Waste Disposal
- Mine Water Management
- Storm Water Management
- Alternatives to Stream Crossings and Diversions
- Post Closure Land Use for Shaft Area
- The No-Go Option

Alternatives were f irstly assessed by the app licant in co nsultation with the m ine design engineers a nd the Environm ental Assessm ent Pract itioner. In certa in instances the technica l design considerations, as well as f inancial re alities, e liminated a lternatives which werer deemed to be viable. Fo r alternatives which remained, and o nce agreem ent was reached on viable alternatives for a specif ic a spect, the alterna tives w ere then p resented to p otentially affected parties for consideration. T he conveyor route is a good exam ple. This m ethod was selected to give com pliance with the *DEAT Guideline 5: Assessment of Impacts and Alternatives*.

The asses sment of alternatives an d the select ion of the Preferred A lternative, was where possible done with the aid of num erical eval uation matrices. Although no t always applicable to all the a lternatives, th e utilization of such decision m atrices provides a useful tool for the assessment of especially the m ore technically oriented alterna tives. The decisio n m atrix provides for the inclusion of a series of aspects related to:

- Technical Practicability (includes cost)
- Environmental Acceptability, and
- Socio-Economic Considerations

The ultim ate objec tive f or altern ative cons ideration is th e sele ction of the BPEO (Best Practicable Environm ental Option). A short disc ussion on the consideration of alternatives will be given.

The Mining Method

Coal mining can be done either as open cast or underground mining. As a result of the depth of coal at Middelbult – Block 8 – Shondoni, opencast mining is not possible and therefore only underground mining methods are viable.

For underground mining, three major methods are used:

- Bord and Pillar Mining, whereby a limited percentage of the coal seam is removed from "bords", whilst "pillars" of coal are left behind in order to support the overlying geological formations. This type of mining ensures a stable overburden and no surface subsidence occurs in mined out areas.
- Increased or High Extraction Mining, whereby sections of the pillars left behind are removed during retreat from certain mining areas. Depending on subsurface conditions, "quartering" or "halving" of pillars are performed. Although the intention is to maintain overburden and surface stability, instability and eventual surface subsidence can ocur if pillar failure occurs with time.
- Total Extraction Mining, whereby the entire coal seam is removed. This type of mining is done through "long walling" or "short walling" where the entire coal seam is cut from the work face, with controlled collapse of the overlying strata, or else through "stooping" when entire coal pillars are removed during retreat from bord and pillar sections. This type of mining results in definite instability, mostly also in surface subsidence, both of which cause increased influx of ground water and surface water into the mine, as well as aquifer dewatering of overlying aquifers.

With the view of minimizing the negative environmental consequences of coal mining, Middelbult – Block 8 – Shondoni has opted for Bord and Pillar Mining with selective High Extraction Mining, in pre-defined mining areas.

Location of Shafts

The location of shafts is an involved procedure (dependant on a host of economical, practical, geological, mining, safety (including ventilation) and environmental (visual, noise, dust, water) considerations) and is done in order to ensure optimal access to, and recovery of, coal from new reserves.

Due to the high costs involved in establishing new shafts, their locations are selected very carefully to present the optimal blend between all the relevant considerations. In the case of the proposed Shondoni Shaft, special consideration was also given to environmental considerations, particularly to protect surface drainage features from impact.

In this regard the construction angle of the incline shaft bears mention. The original design angle of decline of 17 degrees was changed to a decline angle of 12 degrees. This was done to protect a surface drainage feature. Due to the shallower decline angle, the shaft is now much longer and will incur a significant cost implication to the mine.

The Mining Plan

The proposed mining plan was taken through a number of iterations to ensure that due consideration was given to environmental considerations.

High extraction coal mining can manifest as instability in the overlying geological sequence with surface subsidence occurring in the event that the instability propagates all the way from the mined coal seam to the surface. The instability and eventual surface subsidence not only impact on the integrity of the surface and surface infrastructure, but it has a secondary effect in that the overlying aquifers above the mined coal seam (s) dewaters quite rapidly with the result of draining the ground water resources of the overlying land owners into the mine workings. The water entering the mine workings cause mining difficulties and has to be removed from active mining areas.

The ultimate manifestation of this type of impact occurs when "total extraction" mining ("long wall mining", "short wall mining" and "stooping") is practiced. In view of mainly the ground water related impacts associated with this manifestation, Sasol Mining in general has opted out of using this mining technique. It will not be considered at Middelbult - Block 8 - Shondoni.

High extraction mining, which will be considered for selected areas, represents selective pillar mining (usually only parts of any given pillar is extracted), and although subsidence does not usually result from this type of mining, it can occur in extreme conditions.

As part of the ground water specialist study for this project, JMA Consulting has applied a ground water driven mine design tool (specifically developed for Sasol Mining), whereby sensitive areas for high extraction mining (in terms of potential aquifer dewatering and mine water make) can be identified, based on topographical, soil, geological, hydrological and mining configuration information.

The proposed mine plan discussed elsewhere in this EIAR (section 4.8.9.2.6), was designed with due consideration of the above.

Transport Methods for Water, Electricity and Coal

Where-ever possible, Middelbult Mine transports all utilities and ROM coal underground. Water is conveyed in pipes, electricy in cables and coal on shuttle cars and conveyor belts. On surface, coal is transported along surface coal conveyor belts. The only existing conveyor belt on surface runs from the Middelbult Main Shaft towards Sasol Coal Supply (SCS) where the ROM coal is processed for use at Sasol Synfuels.

For the new Shondoni Shaft, undergroung mining, water management and access constraints have necessitated that ROM coal be brought to surface at the shaft, and then must be conveyed to SCS. Between the two options of transport, namely either by road in trucks, or by overland conveyor, the overland conveyor option is the preferred alternative from just about all perspectives (financial, maintenance, practical, environmental, safety, etc).

The proposed overland conveyor will be located in a dedicated servitude. In the event that either electricy, or water, or both need to be conveyed on surface, the reticulation will occur within the same servitude as the overland conveyor. This is to minimize environmental disturbance and to optimize maintenance and security aspects.

Transport Routes for Water, Electricity and Coal

The supply of water and electricity to the proposed Shondoni operations will be from external service providers ESKOM and Rand Water. The routes for transport will be largely determined by these service providers as a function of availability and existing reticulation layouts.

As far as the overland coal conveyor route is concerned, a comprehensive route selection exercise, including Public Participation, was conducted. A separate study report titled: **Sasol Mining – Middelbult (Block 8) Shondoni Project – Alternatives Assessment Overland Conveyor**, was compiled and is attached as **APPENDIX 4.9(A)** to this EIAR IN VOLUME IV of the documentation.

From 3 alternatives, the preferred alternative was identified as the western route. However, although by far the preferred route from most perspectives, the route had one major drawback in the sense that it ran past two residential settlemnts namely Brendan Village and eMbalenhle. Based on comments from the I&AP,s the route alignment was changed to accommodate the concerns of the I&AP's. The route now proposed, is therefore an adaptation of the western route which is now more acceptable to the I&AP's. The outcome of this exercise illustrates the benefit of collective decision taking as intended by the EIA process.

Surface Handling of Coal

The mine design for Shondoni was optimized to minimize the surface handling of coal. The only place, except on the overland conveyor, where coal will be handled on surface, will be at the emergency throw-out coal stockpile at the coal surface bunker, located at the head of the incline shaft. This area represents an emergency facility in the event that normal operation of the bunker discharge system onto the conveyor is compromised.

Domestic and Industrial Waste Disposal

Historically Sasol Mining disposed of all domestic waste at an internal waste disposal facility – the Charlie I landfill was a permitted facility. However, the site has been decommissioned and therefore all domestic and industrial waste generated at the shaft complex will be temporarily stored in specially prepared and demarcated areas at the shaft and will then be removed by licensed contractors to licensed landfill sites, or other appropriate facilities.

Mine Water Management

Mine water management at the mine will be managed in accordance with the requirements of the National Water Act, and in fulfilment of the conditions contained in Regulation GNR 704, which regulates *inter alia* storm water management at mines.

During the operational phase, re-use of dirty water is expected to be less than the water make from mining.

The following hierarchy of water management will apply:

Step 1: Implement pollution prevention at source
Step 2: Implement reuse and minimisation strategies
Step 3: Treatment

To achieve the first two steps, the following measures have been implemented:

- Pillar extraction has not been planned for any areas with shallow cover, with a mining depth of less than 80m. This is to reduce the risk of significant impacts on surface.

- Pillar extraction has been excluded from the following areas:

  - Low lying areas within the mine that are usable as primary storage compartments underground. These areas will be mined bord-and-pillar so as to maximise the available storage underground in the operational phase.

  - Areas with a high risk of significant inflows, such as areas with shallow soil cover, and any rivers or drainage lines. Some of the areas targeted for pillar extraction do have rocky outcrops, and these areas will be surveyed in more detail prior to mining to ensure that rocky outcrop are not undermined as far as is practical, so as to avoid significant inflows.

  - Areas that will be mined by pillar extraction have been planned as separate compartments that can be isolated from the rest of the bord-and-pillar mining post closure, to maintain water quality. Extensive studies have been undertaken to quantify the primary contributors to the mine water make, so that the water make can be minimised.

- Similarly, the geochemistry of the mine water has been investigated to assess the extent to which the quality of the water make can be maximised. Middelbult generally has a more favourable water quality compared to some of the other mining areas in the Secunda Mining Complex.

- As far as is practical, mining is planned so that the low lying areas of the reserve (in terms of coal floor contours) will be mined as quickly as possible. Mining will then move to the higher lying areas, thus permitting water to be left behind or stored in compartments with low pressure seals.

- Dewatering of active areas is planned to allow rapid dewatering to surface of better quality water, in order to prevent deterioration in water qualities. This implies that the circulation of water underground will be minimised as far as is practical. This water will be reused in the plant and coal processing systems.

- As indicated previously, bord-and-pillar areas that have the potential to have stratified water qualities post closure, with a low risk of decant of water affected by mining, have been identified and will be isolated from areas of pillar extraction by means of seals.

However, it is accepted by the mine that, despite the proposed measures to minimise the water make and maximise the reuse of water generated from mining, there will be a water surplus, and water management will be required.

The scenario post closure is that some compartments will potentially stratify with a low risk of decanting water of a poor quality, while others (where pillar extraction has occurred) will have a high risk of decanting poor quality water.

Provision has been made and a commitment given in the EMP to treat any mine water discharged to the surface water catchment post closure. The financial provision for closure is also discussed in the EMP.

The anticpated treatment costs are as follows:

- The membrane technology is estimated to have treatment cost of about R15/ m3 including capital and operating cost. This includes a crystalliser facility.

- For bord-and-pillar mining with selective pillar extraction (as discussed above), the annualised cost during the operational phase is estimated to range from R0.28million in the first year of mining to R2,2million by Year 2011. Thereafter, no additional costs will be incurred, with the underground storage compartments being utilised. Using the current best estimate in terms of operational and post closure water makes, in present value terms at a 6% discount rate, the cost is estimated to be R5million total cost from commencement of mining to closure.

- This compares with figures for pillar extraction from the start of mining and over large proportions of the mines of up to R140 million annual cost towards the end of mining, although reduced by storage underground to around R40 million. The present value of operational costs were computed to vary between R200 and R600 million (again 6% discount rate) for a largely pillar extraction mine, the variation being based on the degree of storage generated underground.

- Even with the delayed pillar extraction mining, the cost if storage is not obtained, as indicated in the proposed plan, is (after discounting) around R140 million.

The optimised layout indicates that the initial bord-and-pillar mining within the first 8 years can provide water storage for the remainder of mining, thus significantly reducing the overall treatment costs. This is a key component of the mining strategy.

It is important to note that these costs are not the definitive costs, since there is further optimisation that is discussed and detailed in this document, but it represents a first estimate of the possible cost implications of water management if not properly optimised.

The post closure costs are estimated to be around R18 million per annum for the initial pillar extraction decant (without neutralisation), increasing to some R30 million per annum once the bord-and-pillar areas begin to decant. However, this costing assumes the bord-and-pillar decant will require treatment, which is not the case. The delay in decant post-mining results in an estimated discounted cost of around R12 million in present value terms.

Not more than 25% of the total mining area north of the dyke will be mined using pillar extraction techniques, while no pillar extraction mining will take place south of the dyke (mined from Middelbult).

Storm Water Management

Storm water management at the shaft complex will be done in accordance with the requirements as specified in regulation GN 704 of the NWA, which deals specifically with mine water management at mines. This will involve the separation of clean and dirty water at the shaft with a series of berms, cut-off canals and bunds around dirty areas. Clean water will be diverted around and off the site whilst dirty water will be captured and contained in a Storm Water Pollution Control Dam with an oil trap.

The topography of the site is such that there is a natural slope on either side of a hill. The People and Materials Shaft will be located on the brow of the hill. After earth works, terracing and paving these natural slopes will have been retained. Full use is made of the natural topography such that the clean buildings being the main entrance, general offices, management offices and parking are all located on the south east slope. Thus the Storm Water falling on this slope will always be clean and as such can be discharged to the existing stream located south of this slope.

Situated on the north east slope are the potentially dirty buildings, being the Diesel Workshop, oil stores and other buildings, all with the possibility to contaminate Storm Water. This entire area will be curbed and where necessary bunded, to channel all Storm Water into the **Shondoni Pollution Control Dam**.

At the exit of the Incline Shaft and the Surface Coal Bunker and Emergency Coal Throw Out area, as second "dirty water area" will also be isolated. This entire area will be curbed and where necessary bunded, to channel all Storm Water into the **ROM Tip Pollution Control Dam**

In terms of the requirements of GN 704 of the NWA, polluted storm water run-off must be contained in a specially constructed Pollution Control Dam (PCD) and may not be discharged into any water resource without DWA authorisation. The water in the PCD can be reused on the mine, or else must be treated to acceptable standards prior to its release back into the environment. Similar to the service water dams, PCD's are also specifically constructed facilities as they contain affected (dirty) water and are also authorized in terms of a NWA section 21(g) water use.

The **Shondoni Surface PCD** will be located on the lower slope of the hill, beyond the site paved area where maximum use of the natural topography will be utilised to create a lined storage dam with a capacity of 80 000 m^3. This dam will also take purified sewage effluent as well as overflow water from the diesel workshop oil skimming unit. Grit traps will be placed on the inlets to the dam. This dam will be sized to take storm water surges. In the future it may be necessary to consider further retention measures or a water treatment facility when additional area run off details have been determined.

The **ROM Tip Surface PCD** will also be located on the lower slope of the hill where maximum use of the natural topography will be utilised to create a lined storage dam with a capacity of 25 000 m^3.

The construction of the Surface Pollution Control Dam facilities will be from the excavated material emanating from the Decline and Vent Shaft, providing this spoil material is suitable for this purpose, otherwise graded material may need to be imported. Controlled run off from the north east slope into this dam could be utilised for later construction activities as well as supplying water for start up.

Alternatives to Stream Crossings and Diversions

Alternatives for these have been considerd during the conveyor route selection as well as during the incline shaft design.

For the final conveyor route selected, one additional stream crossing had to be included due to moving of the convey or to acco mmodate noise and safety concerns from re sidents in eMbalenhle.

The alternative selected for the in cline shaft angle of decline, was selected at sign ificant cost to Sasol Mining, in order to protect a surface drainage line and to prevent a diversion.

Post Closure Land Use for Shaft Area

The land affected by the shafts and conveyors will be returned to agricultural use after mining. Over the rest of the area land use will remain unchanged.

Should a viable post closure use by found for the shaft surface infrastructure such as the offices, workshops, change houses, etc, such potential uses will be assessed for viability and a decision will be taken accordingly.

The No-Go Option

If the proposed Shondoni project does not proceed, coal for Saso l Synfuels will have to be sourced from Sasol Mining or non-Sasol Mi ning reserves further away, affec ting the economic viability of its existing and future production. The new m ine is required to sustain coal production and feedstock to the plant as ex isting m ines com e to the end of their life. Without this substitu tion, significant staff layoffs can be expected, s everely im pacting th e socio-economic structure of the Secunda area.

Current Environmental Status

The current environmental status has been described for the Middelbult-Block 8 reserves for the compilation of the Middelbult EMPR (approved in 2002) and for the Block 8 EMPR Addendum (approved in 2004). This current document was compiled to serve as an EMPR Addendum in order to authorize a new shaft (Shondoni Shaft) with its associated mining and surface coal conveyor, within the Block 8 reserves, but also to apply for three additional reserve blocks namely Leeuwpan, Springbokdraai and the Block 8 Northern Reserves.

Whereas the base line descriptions for both the Middelbult and block 8 Reserves were therefore already available, additional studies were conducted within the newly applied for reserve blocks. The same specialist consultancies used for the Block 8 base line studies, were again appointed to perform the additional work, with specific instructions to ensure seamless integration of the existing descriptions with the descriptions of the newly added areas. Unfortunately, the level of detail, especially on base line maps, available for the old Middelbult Reserves, was in most instances not nearly sufficient to be able to populate the new maps to include the old Middelbult Reserves. However, the base line descriptions in the text was adapted to also portray the descriptions contained in the original Middelbult EMPR. Representing formally approved base line descriptions, the information for the existing Middelbult and Block 8 Reserves could not be upgraded as it would then override previously approved information.

Additional base line work (in addition to existing Middelbult and Block 8 descriptions) performed to cover specifically all activities related to the proposed new Shondoni Shaft, the proposed new overland coal conveyor, the three new reserve blocks, as well as the adapted mine plan related to the Shondoni Shaft and extraction of coal from the new reserves, included work related to the following:

- Topography
- Soils
- Land Capability and Land Use
- Geology
- Ground Water
- Surface Water
- Plant Life
- Animal Life
- Aquatic Ecosystems (Streams, Wetlands, Pans)
- Noise
- Visual Aspects
- Heritage Aspects
- Socio-Economic Aspects (New Sasol Mining Social and Labour Plan)

The remainder of the base line descriptions were based on the most recent descriptions as contained in the Block 8 EMPR Addendum, which are still believed to be relevant to the study area.

- Meteorology
- Air Quality

The Current Environmental Base Line is discussed in detail Chapter 5 of the EIAR. The specialist reports on which a number of these base line descriptions are based, are all attached as APPENDICES in VOLUME IV of this submission.

Environmental Impact Assessment

Impact Assessment Methodology

The impact assessment methodology used for the Middelbult – Block 8 - Shondoni Project is based on a Sasol Mining Standard Impact Assessment Rating Matrix. This matrix was developed in-house by Sasol Mining, but nevertheless contains all the critical elements for Environmental Impact Assessment as proposed in the formal DEAT Protocol for Environmental Impact Assessment – *DEAT (2002) Impact Significance, Information Series 5, Department of Environmental Affairs and Tourism (DEAT), Pretoria.*

The protocol comprise a series of steps in order to systematically go through a process of:

1. Identifying and quantifying an impact (determining the severity). **Step 1**.
2. Calculating the likelihood of an impact happening. **Step 2.**
3. Quantification of the level of magnitude attached to the impact. **Step 3.**

During the identification process the following aspects are considered:

- The physical quantity of the potential impact (be it a volume, concentration or quantitative measurement).
- The toxicity of impact, measured against a pre-defined hazard rating.
- The measurement of the extent of an impact.
- The duration of the impact, measured in years.
- The environmental status of the impact.
- The regulatory impact in terms of legislation that has relevance.
- The impact on any Interested and Affected Parties.

A quantitative rating system is used to assign a value to each of the above aspects:

Impact Assessment Criteria used at Middelbult – Block 8 - Shondoni

Criteria	Definition	Points
Quantity	**The quantity (Volume) that will impact on the environment**	
	Less than 1m^3 / incident or > 10 mg/ m^3 or < 61dBa	0
	More than 1 m^3 but less than 10 m^3 per incident or > 25 mg/ m^3	1
	More than 10 m^3 but less than 100 m^3 per incident > 50 mg/ m^3 or > 61dBa	2
	More than 100 m^3 but less than 1000 m^3 per incident or > 100mg/ m^3	3
	More than 1000 m^3 per incident \ continuous or > 120 mg/ m^3 or > 85dBa	4
Toxicity	**Hazard rating (Dangerous properties of hazardous material)**	
	Non-hazardous – (substances which will not result in any risk)	0
	Hazard rating 1 – (Substances which could result in relatively low risk)	1
	Hazard rating 2 – (Substances which could result in serious risk)	2
	Hazard rating 3 – (Substance which could result in severe risk)	3

Extent	How far does the impact extend?	
	Limited to Business unit	0
	Limited to mine lease area	1
	Regional (Refer to TEKSA area)	2
	National (Refer to Mpumalanga area)	3
	International (refer to beyond South Africa's boundaries)	4
Duration	**How long will the impact last?**	
	Less than 5 years	0
	Between 5 – 15 years	1
	Exceeding mine lifetime	2
	Impact permanently present	3
Status	**Status of impact**	
	Beneficial (Improve the environment) – no risk reduction needed	-1
	Neutral (No change to the environment) – No risk reduction needed	0
	Adverse (Degradation of the environment) – Risk reduction needed	1
Legislation	**Are there any regulatory requirements applicable to aspects – impacts?**	
	None	0
	Yes, No fines, not cause loss of operating permit, but still reportable incident	1
	Yes, and will result in / prosecution or loss in production	2
	Yes, and will cause loss of operating permit or mine stoppage.	3
	Yes, and may lead to closing down of mine	4
I & AP's	**Interested and affected parties (I&AP)**	
	No impact	0
	Impact to employees in unit	1
	Impact to local community / stakeholders	2
	Impact to general public – beyond TEKSA area (Bad publicity)	3

Once a sum value has been determined for a s pecific im pact, an Im pact Severity Score is calculated (C-number) as **Step 1**, based on the Table below:

Impact Assessment Criteria used at Middelbult – Block 8 - Shondoni

Severity score	Risk matrix Consequence Category
21 - 22	C7
19 - 20	C6
17 - 18	C5
14 - 16	C4
10 - 13	C3
5 - 9	C2
Less than 5	C1

During **Step 2** the likelihood of an impact occurring/re-occurring is assessed at the hand of the Table provided below:

Likelihood of an Impact Occurring (P-value).

Likelihood Descriptors	Probability Intervals	Likelihood Definitions	P-value
Unforeseen	0 – 0.1%	The event is not foreseen to occur	P1
Highly unlikely	0.1 – 1%	The event may occur in exceptional circumstances (very remote)	P2
Very unlikely	1 – 5%	The event may occur in certain circumstances (remote chance)	P3
Low	5 – 15%	The event could occur (moderate chance)	P4
Possible	15 – 40%	The event may occur (realistic chance)	P5
Likely	40 – 75%	The event will probably occur (significant chance)	P6
Almost Certain	75 – 100%	The event is expected to occur or occurs regularly	P7

Finally, the overall impact is quantified in a "Level of Risk" matrix, by combining the C-value (calculated in **Step 1**) with the P-value (calculated in **Step 2**) in the matrix provided below (**Step 3**). The overall impacts will be ranked based on the Level of Risk, as identified below:

Level of Risk Matrix for Impacts at Middelbult – Block 8 - Shondoni

	P1	P2 P3 P4			P5 P6 P7		
C7	Level 3 Risk	Level 3 Risk	Level 3 Risk	Level 1 Risk	Level 1 Risk	Level 1 Risk	Level 1 Risk
C6	Level 3 Risk	Level 3 Risk	Level 3 Risk	Level 2 Risk	Level 2 Risk	Level 2 Risk	Level 1 Risk
C5	Level 4 Risk	Level 4 Risk	Level 4 Risk	Level 3 Risk	Level 2 Risk	Level 2 Risk	Level 2 Risk
C4	Level 5 Risk	Level 5 Risk	Level 5 Risk	Level 3 Risk	Level 3 Risk	Level 3 Risk	Level 3 Risk
C3	Level 6 Risk	Level 6 Risk	Level 6 Risk	Level 5 Risk	Level 5 Risk	Level 5 Risk	Level 4Risk
C2	Level 6 Risk	Level 6 Risk	Level 6 Risk	Level 6 Risk	Level 6 Risk	Level 6 Risk	Level 5 Risk
C1	Level 6 Risk	Level 6 Risk	Level 6 Risk	Level 6 Risk	Level 6 Risk	Level 6 Risk	Level 6 Risk

The matrices shown above make use of generic criteria in order to systematically identify, predict, evaluate and determine the significance of impacts resulting from project construction, operation and decommissioning. However, in order to enhance the accuracy and integrity of the outcome of the Impact Assessment, the suite of potential environmental impacts (to both the natural and human environments) identified in the EIA, were as far as possible **quantified during the various specialist studies conducted**.

Constraints and Limitations of Impact Assessment

The base line studies conducted for the Sasol Mining Middelbul t – B lock 8 – S hondoni EIA/EMPR and re lated Authoriza tion Processe s, represents the basis from which to assess impacts related to both existing and proposed mining activities and also provides the required environmental objectives to be pursued dur ing the conceptualization and design of environmental management measures.

Insufficient base lin e characterization could therefore present constraints to im pact assessment. Not all of the environm ental components considered during th e base line studies are prone to actual im pacts at Middelbult – Block 8 – Shondoni, m ost notably m eteorology and geology. However, deficiencies in the desc ription of these aspects, could influence the assessment of impacts related to other environmental components.

A high integrity Environmental Impact Assessment requires three fundamental compontents:

- highly accurate and site specific base line de scriptions supported with data generated through on site observation/measurement and monitoring.
- detailed qu antitative pro cess de scriptions related to a ll activ ities th at co uld im pact on the environment in order to be ab le to id entify and desc ribe all poten tial impacts of the acitivty on the environment.
- sophisticated im pact assessm ent tools that can describe an d assess im pacts through all the lif e cyc le phases of the pro ject, includ ing ca lculation to ols and sim ulation m odels that can simulate the ef fects of a ctivities on the rece iving environment in a tra nsient manner.

In view of the above, and based on the work performed for this project and which is discussed extensively in the EIAR , it is believed that the Environm ental Impact Assessment conducted for Middelbult – Block 8 – Shondoni, is indeed of high qua lity and in tegrity. The constraints and lim itations that we re iden tified, were tak en into con sideration d uring the n umerical ratings in the sense that where they could infl uence the rating, the m ore conservative rating was always selected.

Identification of Activities/Aspects

During the impact assessm ents performed by the va rious specialists in their spec ialist studies, each specialist identified impacts based on his/her experience and with reference to the project description provided by the EAP for the pro ject (JMA Consulting). This was done to ensure that specialists are not guided to only addr ess im pacts specif ically m entioned in "Listed Activities" but tha t th ey would indeed iden tify and ass ess all ac tivities re lated to the Middelbult – Block 8 – Shondoni Mine's current and future operations and which may impact on the env ironment. The f ull spe cialist repo rts com piled by the d ifferent spec ialists a re contained as APPENDICES in VOLUME IV of this submission.

However, f or th is EIA R, the EAP stru ctured the "Activities/Aspec ts" which nee ded to b e assessed, in groups relating to the legal authoriz ation process requirem ents as relevant to the different regulating authorities, nam ely Mpumalanga DEDET and Gauteng DWA. In addition to this, and specifically to support the develo pment of the overall comprehensive EIA/EMP for the Mine in support of the requirem ents of DMR, including already authorized existing Shafts at Middelbu lt and Block 8, activ ities requiring assessm ent for the EMP design purposes were additionally identified and grouped into three additional categories, namely:

- Middelbult – Block 8 – Shondoni Surface Shaft Activities. (The activities identified for these areas were compiled subject to the detailed Shondoni Shaft Activity Inventory as compiled from the detailed project description for the new shaft (Shondoni Techno-Economic Study), supplemented with all activities identified at the remaining Middelbult – Block 8 Shafts as contained in the previous two approved EMPR's – Main Shaft, West Shaft, Ithembalethu Shaft. North Shaft and North West shaft have been decommissioned and closed).
- Middelbult – Block 8 – Shondoni Underground Mining Activities. (The underground mining activities related to the Middelbult – Block 8 Mine, and which could impact on the environment, have all long been identified, described and assessed. From a pure mining perspective, the Shondoni project merely represents an altered and extended underground mine plan. No "new" impacts are therefore anticipated, but the changes and extensions to the underground mine plan have necessitated that the impacts had to be revisited and re-assessed).
- Middelbult – Block 8 – Shondoni Coal Conveyor Activities. (Activities related to two conveyors are relevant. The first one has been in operation since the days of the original Middelbult EMPR that was approved in 2002. The second conveyor is the new one proposed for the Shondoni project.

Once an activity was identified, it is assumed that it will run through all the life cycle phases of the project namely, **construction phase, operational phase, decommissioning and closure phase, and post closure phase**. However, for previously approved activities, although some are still operational, others have already been decommissioned and closed, such as for example the Middelbult North Shaft and Middelbult North West Shaft.

NEMA EIA Listed Activities (GNR 386 & GNR 387)

National Environmental Management Act, Act No. 107 of 1998		
Section 24	**Environmental Authorisation Application**	
GNR 386		
Activity 1(c)	The construction of facilities or infrastructure, including associated structures of infrastructure, for the storage of 250 tons or more but less than 100 000 tons of coal	Coal throw out stockpile area at Shondoni Shaft
Activity 1(m)	The construction of facilities or infrastructure, including associated structures of infrastructure, for any purpose in the 1:10 year flood line of a river or stream, or within 32 *m* from the bank of the river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including – (i) canals; (ii) channels; (iii) bridges; (iv) dams; (v) weirs	Conveyor Pedestal for crossing of Trichardt Spruit
Activity 1(n)	The construction of facilities or infrastructure, including associated structures of infrastructure, for the off-stream storage of water, including dams and reservoirs, with a capacity of 50 000 cubic metres or more, unless such storage falls within the ambit of the activity listed in item 6 of Government Notice No. R. 387 of 2006	Service Water Dams and Storm Water Pollution Control Dam at Shondoni Shaft Complex
Activity 4	The dredging, excavation, infilling, removal or moving of soil, sand or rock exceeding 5 cubic metres from a river, tidal lagoon, tidal river, lake, in-stream dam, floodplain or wetland.	Excavation for Coal Conveyor Pedestal for crossing of Trichardt Spruit
Activity 7	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic metres but less than 1 000 cubic metres at any one location or site.	Diesel Fuel Storage Tanks at Shondoni Shaft Complex
Activity 12	The transformation or removal of indigenous vegetation of 3 hectares or more or of any size where the transformation or removal would occur within a critically endangered or an endangered ecosystem listed in terms of it section 52 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	Removal of Indigenous Vegetation during Site Clearance for Construction of Shondoni Shaft Complex and related Infrastructure

Activity 13	The abstraction of groundwater at a volume where any general authorisation issued in terms of the National Water Act, 1998 (Act No. 36 of 1998) will be exceeded.	Removal of water found in the underground workings on the No.4 Seam and the No.2 Seam workings to facilitate the efficient continuation of mining and for the safety of people
Activity 14	The construction of masts of any material or type and of any height, including those used for telecommunication broadcasting and radio transmission.	Tetra Radio System that will be installed above ground at the Shaft Complex Area.
Activity 15	The construction of a road that is wider than 4 metres or that has a reserve wider than 6 metres, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 metres long.	Access Road to Shondoni Shaft Complex from Tar road R547
GNR 387		
Activity 1 (l)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the transmission and distribution of above ground electricity with a capacity of 120 kilovolts or more.	Double Circuit 132 kV Overhead Poweline from Eskom Supply Point (SOL B) to Shondoni Mine Transmission Feeder Bays.
Activity 1(j)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the bulk transportation of dangerous goods using pipelines, funiculars or conveyors with a throughput capacity of 50 tons or 50 cubic metres or more per day.	Coal Conveyor from Shondoni Shaft to Middelbult Main Shaft (Sasol Coal Supply, the central coal stockpile area).
Activity 2	Any development activity, including associated structures and infrastructure, where the total area of the developed area is, or is intended to be, 20 hectares or more.	Developed area including shaft surface infrastructure and conveyor route.

NWA Water Uses

National Water Act, Act No. 36 of 1998		
NWA Section 40	**Integrated Water Use License Application (Includes Registrations)**	
Section 21(a)	Taking water from a water resource	Service water used underground sourced from underground water make (21(j))
Section 21(c)	Impeding or diverting the flow of water in a watercourse	Coal conveyor from Shondoni Shaft to Central Coal Stockpile Area
Section 21(f)	Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit	Shondoni Shaft Sewerage Plant
Section 21(g)	Disposing of waste in a manner which may detrimentally impact on a water resource	Shondoni Shaft Service Water Dams, Storm Water PCD and Shondoni Shaft Berms Walls
Section 21(i)	Altering the bed, banks, course or characteristics of a watercourse	Coal Conveyor from Shondoni Shaft to Central Coal Stockpile Area. Possible stream diversion at Shaft Locality for Incline Shaft.
Section 21(j)	Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people	Removing Mine Water Make from the No.4 Seam and No.2 Seam Underground Works
NWA Section 39	**General Authorisations**	
Section 21(c)	To be applied for in consultation with DWAF	
Section 21(f)	To be applied for in consultation with DWAF	
Section 21(g)	To be applied for in consultation with DWAF	
Section 21(i)	To be applied for in consultation with DWAF	
GNR 1352	**Water Use Registration**	
	Included in Water Use License Application and/or General Authorisation	

NWA GNR 704 Activity Exemptions

National Water Act, Act No. 36 of 1998		
GNR 740 (R 3)	**Exemptions from GNR 704**	
Regulation 4 (a) (Restrictions On Locality)	No person in control of a mine or activity may 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 water course or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on water-logged ground, or on ground likely to become water-logged, undermined, unstable or cracked.	Shondoni Shaft Complex
Regulation 4 (b) (Restrictions On Locality)	No person in control of a mine or activity may, except in relation to a matter contemplated in Regulation 10 (winning sand and alluvial minerals), carry on any underground or opencast mining, prospecting or any other operation or activity under or within the 1:50 year flood line or within a horizontal distance of 100 metres from any water course or estuary, whichever is the greatest.	Entire Middelbult, Block 8, Springbokdraai and Leeuwpan Reserve
Regulation 4 (d)	No person in control of a mine or activity may use any area or	Shondoni Shaft Complex and Coal Conveyor

(Restrictions On Locality)	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 water course or estuary.	from Shondoni Shaft to Middelbult Main Shaft (Sasol Coal Supply, the central coal stockpile area).
Regulation 5 (Restrictions On Use of Material)	No person in control of a mine or activity may use any residue or substance which causes or is likely to cause pollution of a water resource for the construction of any dam or other impoundment or any embankment, road or railway, or for any other purpose which is likely to cause pollution of a water resource.	Use of overburden material excavated from Shondoni Shafts for construction of berms around Shondoni Shaft Complex

NEMWA Listed Waste Management Activities

National Environmental Management Waste Act, Act No. 59 of 2009		
NEMWA Section 45	**Application for Waste Management Licences**	
Category B (7)	Treatment of sewage with an annual throughput capacity of 15 000 cubic metres or more.	Shondoni Shaft Sewerage Plant.

MPRDA Middelbult – Block 8 – Shondoni Surface Shaft Activities

Mineral and Petroleum Resources Development Act, Act No. 28 of 2002	
MPRDA Section 44	**Mining Right Application**
Shondoni Shaft, Main Shaft, West Shaft and Ithembalethu Shaft	
Site clearance prior to construction	
Storage of topsoil stripped during construction	
Compaction of in-situ footprints prepared for infrastructure construction	
Excavation during shaft sinking (vertical and incline)	
Storage of materials generated during shaft sinking	
Construction of access road	
Construction of surface buildings, shaft headgear, parking areas, etc	
Construction of surface coal handling facilities (bunker, throw-out area, emergency stockpile)	
Construction of water management infrastructure(canals, berms, silt traps, dams)	
Erection of security fences	

MPRDA Middelbult – Block 8 – Shondoni Underground Mining Activities

Mineral and Petroleum Resources Development Act, Act No. 28 of 2002	
MPRDA Section 44	**Mining Right Application**
No.4 Seam and No.2 Seam Underground Bord and Pillar and Selective High Extraction Mining	
Primary development and bord and pillar mining on the No.2 coal seam horizon	
Primary development and bord and pillar mining on the No.4 coal seam horizon	
Possible increased extraction on the No.4 coal seam horizon	
Storage of excess mine water in mined underground sections	

MPRDA Middelbult – Block 8 – Shondoni Coal Conveyor Activities

Mineral and Petroleum Resources Development Act, Act No. 28 of 2002	
MPRDA Section 44	**Mining Right Application**
Shondoni Shaft Conveyor and Main Shaft Conveyor	
Site clearance along conveyor servitude	
Storage of topsoil stripped during construction	
Excavation for conveyor pedestals	
Construction of conveyor and conveyor housing	
Construction of (over and under) road crossings	
Erection of security fences	

Identify and Assess Impacts – Specialist Studies

Based on the identified "activities and aspects" each specialist identified and assessed impacts related to each of the relevant environmental components during the specialist study phase of the project.

Meteorological Assessment

A dedicated meteorological specialist study was not conducted for this project. The information contained in Chapter 5 of this report was collated from other specialist studies and represents base line information in support of other specialist studies that require meteorological data, such as ground water, surface water, air quality and noise. The activities at Middelbult – Block 8 – Shondoni will not have any effect on the meteorology or climate of the study area.

Topographical Assessment

Although a dedicated topographical specialist study was not conducted for this project, Sasol Mining was already in possession of a detailed DTM for the study area, which provides the base line data in support of other specialist studies that require topographical data, such as ground water, surface water and visuals. However, high extraction coal mining as planned for certain sections of the No.4 seam in the Block 8 – Shondoni area, could under certain conditions result in surface subsidence. The base line topographical data available, and used in this report, will facilitate identification and quantification of such subsidences in the unlikely event that it does occur.

Soils Assessment

A higly quantitative, analytical Soils Study was undertaken for the Middelbult – Block 8 – Shondoni project, the results of which are detailed in a Soils Specialist Study which is attached as APPENDIX 5.3(A) in VOLUME IV of this submission. The high integrity base line study, which included field observation and soil sampling on a predetermined grid, followed by soil laboratory analyses, facilitated a high integrity empirical/analytical impact assessment for large sections of the old, already mined out, Middelbult Reserve, for the entire Block 8 Reserve, as well as for the three new reserve blocks, Springbokdraai, Leeuwpan and Block 8 Northern Reserves.

Land Capability & Land Use Assessment

A specialist study was conducted to assess land capability and land use from a biophysical perspective. The specialist report, which is a combined report with the soils study, is attached as APPENDIX 5.3(A) in VOLUME IV of this submission. The biophysical assessment defined the current land use, as well as the soil/land potential, for different land use applications.

The impact assessment for land capability and land use is an empirical/analytical one, supported with accurate quantitative onsite information on current land use, supplemented with soil physical and chemical impact information for the current activities as generated during the soils study. From a legal land capability and land use perspective, the information contained in the Property Description in Chapter 4 of VOLUME I of this report, details the zoning status for each of the properties located within the larger mine lease area.

Geological/Geochemical Assessment

The specialist work conducted for the geologic al/geochemical assessm ent, repres ents bas e line inform ation required to support i mpact asse ssments related to land capability and land use, ground water, surface water, plant life, an imal life, wetlands, aquatic ecosystem s, and air quality. The results of these as sessments are contained in one com bined Specialis t Reports, namely a Geology Specialist Report attached as APPENDIX 5.5(A) in VOLUME I V of this submission.

The information generated is of a highly accu rate, site specific, quantitative nature an d which will suppo rt both analytical and s tochastical impact assess ment. The geological regim e was quantified through on site borehole drilli ng and sam pling, both by Sasol Mining for geological exploration, as well as by JMA, for investigative purposes, followed by laboratory testing of ABA sa mples, resulting in both phys ical and geochem ical characterization of the geological regime.

Ground Water Assessment

A higly quantitative, site spec ific geohydrological investigation, comprising a base line study, impact assessment and design of a ground water management measures and m onitoring plan was conducted for the Middelbult – Block 8 – Shondoni project. A copy of the Ground Water Specialist R eport is attaced as APPENDIX 5.6(A) in VOLUME IV of this subm ission. The ground water im pact assessm ent is of very high integrity and contains elements of empirical and analytical m ine water balan ce, and salt b alance, im pact as sessment. The base line study provided all the necessary quantitative data to facilitate analytical impact modelling for a wide range of ground water related impacts.

Surface Water Assessment

A surface water specialist repor t is attached as APPENDIX 5.7(A) in VOLUME IV of this submission. The highly accurate and quantit ative Meteoro logical and Topographical information generated for the project, enab led high integrity hydrol ogical calculations and modelling to be perform ed for the existing and proposed m ining activities. The impact of existing and proposed new facilities on the storm water run-off volum es and quality of the site, could therefore be assessed analytically to a very high degree of confidence.

Plant Life Assessment

A Plant Life Specialist Report is attached as APPENDIX 5.8(A) in VOLUME I V of this submission. The survey conducted h as resu lted in an accu rate em pirical/analytical plant lif e impact assessment for both the current, as well as future activities.

Animal Life Assessment

An Ani mal Life Specialist Report is attached as APPENDI X 5.9(A) in VOLUME IV of this submission. The survey conducted resulted in an accurate em pirical/analytical anim al life impact assessment for both the current, as well as future activities.

Wetland Assessment

A Wetland Specialist Report is attached as APPENDIX 5.10(A) in VOLUME IV of this submission. The survey conducted resulted in an accurate empirical/analytical animal life impact assessment for both the current, as well as future activities.

Aquatic Ecosystems Assessment

An Aquatic Ecosystems Specialist Report is attached as APPENDIX 5.11(A) in VOLUME IV of this submission. The survey conducted has resulted in an accurate empirical/analytical aquatic ecosystems impact assessment for both the current, as well as future activities.

Air Quality Assessment

The only air quality impacts that will be associated with the mine, will occur during the construction and decommissioning phases and will be related to dust and gaseous emissions from construction vehicles. In view of the documented limited extent, duration, intensity and significance of these air quality impacts, and in view of the standard management measures which will be applied by the contractors during these activities, an air quality specialist study was not deemed to be required. This aspect has been documented in the Scoping Report and Plan of Study and was approved by the I&AP's as well as the authorities.

Noise Assessment

A Noise Specialist Report is attached as APPENDIX 5.13(A) in VOLUME IV of this submission. The survey conducted, represents the current situation at Middelbult – Block 8 – Shondoni for winter, day and night conditions, thus resulting in an accurate empirical/analytical noise impact assessment for both the current, as well as future activities.

Visual Assessment

A Visual Aspects Specialist Report is attached as APPENDIX 5.14(A) in VOLUME IV of this submission. The survey conducted, represents the current situation at Middelbult – Block 8 – Shondoni, thus resulting in an accurate empirical/analytical visual impact assessment for both the current, as well as future activities.

Heritage Assessment

A Heritage Aspects Specialist Report is attached as APPENDIX 5.15(A) in VOLUME IV of this submission. The survey conducted, represents the current situation at Middelbult – Block 8 – Shondoni, thus resulting in an accurate empirical/analytical heritage aspects impact assessment for both the current, as well as future activities.

Socio-Economic Assssment

The study is supported by an approved Social and Labour Plan, a copy of which is attached as APPENDIX 5.16(A) in VOLUME IV of this submission.

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Assessment of Impact Significance

For a detailed and in depth discussion on the assessment of impact significance for each of the individual environmental components, please refer to the Specialist Study Reports contained in VOLUME IV of this submission.

However, for the purposes of this EIAR, the project EAP, JMA Consulting, collated and summarized all the available impact assessment information from the Specialist Study Reports into Impact Significance Assessment Tables.

The method used to compile these Tables is described in section 6.1 of the EIAR, the aspects related to each of the NEMA and NEMWA listed activites, the NWA Water Uses and GNR 704 Exemptions, as well as the different MPRDA Mining Activities at Middelbult – Block 8 – Shondoni, have been identified in section 6.3, and the impacts associated with each aspect have been obtained from the specialist study reports.

Tables have been compiled for each of the Middelbult – Block 8 – Shondoni life cycle phases, construction, operation, decommissioning and closure, as well as post closure. For currently existing activities/aspects, the construction phase has obviously not been assessed. However, for all new/proposed activities/aspects, impacts have been assessed for each life cycle phase.

The Impact Assessment Tables contain the following columns:

- Activity/Aspect Description
- Impact Identification and Description
- Quantity
- Toxicity
- Extent
- Duration
- Status
- Legislation
- I&AP's
- Severity Total
- Severity C Number
- Degree of Likelihood
- Risk Level Before Mitigation

The Risk Level rating/classification represent the pre-management assessment. An after management Risk Level rating will be contained in the Management Measures Tables.

The Impact Assessment Tables are contained in Chapter 6 of the EIAR. A summary of the Key Findings will be discussed later in the Executive Summary.

Cumulative Impacts

In areas where extensive mining and associated industrial activities occur, as is the case for the greater Secunda area, impacts experienced at individual mines and/or plants may combine, and whereas they may be of acceptable magnitude and significance on individual mine/plant scale, could after they have accumulated, be fully un-acceptable on a regional scale.

Most of the identified biophysical and socio-economic impacts related to coal mining have the potential to accumulate and therefore have to be considered. In this regard, however, it is important to separate those that would accumulate linearly and those that would accumulate exponentially.

Linear accumulation is defined for impacts for which the aerial extent and zone of influence is directly related to the extent of the surface area where the impact is generated and occurs, or impacts for which the time duration is short. Examples of environmental attributes for which this is the case are:

- Topography
- Soils
- Land Use and Land Capability
- Geology
- Heritage

Exponential accumulation is defined for impacts for which the aerial extent and zone of influence exist beyond the extent of the surface area where the impact is generated and which could therefore increase in significance as it combines with the manifestations of other external impacts generated by neighbouring or down-gradient/down-stream sources.

Examples of environmental attributes for which this is the case are:

- Ground Water
- Surface Water
- Plant Life
- Animal Life
- Aquatic Ecosystems
- Air Quality
- Noise
- Visual Aspects
- Socio-economic Aspects

The specialist impact assessment reports commissioned for this Sasol Mining: Middelbult – Block 8 – Shondoni EIA/EMP project, addressed the cumulative impacts related to the exponential accumulation attributes listed above.

Ground Water

The cumulative impacts associated with ground water relates to the progressive mine water make resulting form aquifer dewatering, which increases linearly as the underground workings expand. Under normal bord and pillar mining conditions, the overlying aquifers remain structurally intact, but if overlying strata collapse should occur as a result of high extraction mining, the water make increases exponentially.

This phenomenon invariably results in the situation that the mine water make for an individual mine becomes greater than the underground storage capacity in the mine, resulting in the requirement to store excess mine water on surface. This situation is a reality at Sasol Mining in Secunda, where an integrated surface water management system for excess mine water has been developed – discussed in Chapter 4 of VOLUME I of this submission.

The magnitude of the excess mine water make can be limited if only bord and pillar mining, supplemented with limited high extraction is conducted. It is essentially for this reason that the proposed extensions to underground mining at Middelbult – Block 8 – Shondoni will employ only bord and pillar, with selective high extraction.

Surface Water

Sasol Mining is the only coal mining operation that potentially impacts on the Waterval River catchment. This includes all of Sasol's Secunda mining complexes, with the exception of Syferfontein Colliery and TCTS.

At present all mining in the catchment is underground, with no current plans for opencast mining. Of the underground, the vast majority is bord & pillar, with some 25% to 30% of the mined out areas being high extraction.

The cumulative impact on catchment yield is therefore expected to be relatively low. In addition, with dirty water contained in underground workings, the impact on water quality is also expected to be relatively low.

Other industrial and mining activities that potentially impact on the Waterval River catchment include the Sasol Secunda Industrial Complex, as well as some gold mines in the vicinity.

Plant Life

The proposed project is within a relatively disturbed landscape. From a vegetation and flora point of view, there has been a large amount of change within vegetation in this region. This has led to vegetation types within the study area being classified according to the Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004) as Vulnerable. Additional loss of vegetation in the study area may further reduce the extent of vegetation, but will be a relatively small change compared to existing change due primarily to cultivation, urban expansion and other mining.
The current project proposes underground mining with a small proportion of above-ground infrastructure. There will therefore be a small cumulative impact by this project, when taken in combination with existing changes in the area.

Animal Life

A cumulative impact can arise due to the combination of impacts from the project being evaluated with related impacts from other projects. These cumulative impacts occur when the project impacts compound the effects of other past, present and (expected) future projects, causing an increase in environmental degradation which is greater than that expected from the project being evaluated alone.

Cumulative impacts which are likely to occur are a loss of vegetation and habitat, habitat fragmentation and possibly a decrease in water quality, which will negatively impact the quality of remaining habitat. Urban expansion occurring in the surrounding towns and increased cultivation will cause an additional decrease in natural habitat and will lead to increasing fragmentation of the remaining habitat. Pollution originating from urban areas, roads, farming practices and other mining activities in the catchments are all expected to negatively impact the water resource, thereby further reducing the quality of available habitat, especially for those species utilizing wetland or riparian habitats.

Therefore the Shondoni Project can potentially contribute to accumulation of negative impacts on the environment and the terrestrial fauna, and for this reason, those mining activities contributing to the above mentioned cumulative impacts need to be carefully considered and every effort must be made to prevent the impacts from occurring, and if unavoidable, suitable mitigation measures should be carried out to minimize the impact.

Aquatic Ecosystems

Potentially the most significant cumulative impact that could be associated with the proposed Shondoni Project, is that of deteriorating water quality within the Waterval River and the Vaal River further downstream. The cumulative impact that coal mining could have on water quality is illustrated by current conditions in the Upper Olifants River, where the salinity loads already exceed the Resource Water Quality Objectives for the Upper Olifants River.

In general the southern coalfields are charaterised by higher sodium concentrations, indicating a serious risk of deteriorating water quality due to increased salinities with in the rivers draining this area, namely the Vaal River and its tributaries, once the coal mines in the area start decanting. Decanting of acidic water must also be considered.

While numerous new coal mines and shafts have in the recent past been commissioned in the Secunda region, it is important to recognise the time lag between commissioning of the mine and decanting of polluted water. The life of mine of the Middelbult Reserve will be extended to 2041 by the Shondoni Shaft, where after it could take several years before the mine starts decanting polluted water.

While polluted decant from one or two of these mines might be within the assimilative capacity of the receiving water resources, the combined impact of polluted decant from all of the collieries within the Vaal River will need to be considered to accurately assess the significance of this impact. Given the reliance of South African industry on water obtained from the Vaal River, the maintenance of water quality within this river should be of utmost importance.

The construction and operation of the surface infrastructure will aloso contribute to the cumulative loss of natural habitats and biodiversity within the Secunda area.

Air Quality

Due to the inherent dispersion of air pollution through the atmosphere, any atmospheric emission originating from a primary or secondary source is bound to accumulate and manifest in the ambient air quality for any specific site or area. For the Sasol Mining: Middelbult – Block 8 – Shondoni EIA/EMP project, air quality impacts will be secondary in nature and will be related to dust pollution and gaseous emissions due to construction activities.

These activities, and therefore their associated air quality impacts, will be very limited in extent and duration and is not expected to contribute significantly to a cumulative air quality impact in the region.

Noise

The ambient noise profile for any region or site, is determined by the ongoing noise propagated from existing sources in the area. The Middelbult – Block 8 – Shondoni

operations do contribute to the ambient noise profile through noise propagated from overland coal conveyor belts, ventilation upcast shafts, and general road traffic on surface. As such the new expansions proposed, will no doubt contribute cumulatively to the ambient noise profile of the area, especially as the first two noise sources mentioned will be operated on a 24 hour/day basis.

Visual

Accumulation of visual impacts within a larger geographic area, essentially defines the "sense of place" of a site. Being located regionally within an overall mining and industrial region, the limited extent, isolated occurrence and mining/industrial nature of visual impacts caused by Sasol Mining: Middelbult – Block 8 – Shondoni activities, is not deemed to alter the "sense of place" of the area in which it is located.

Socio-Economic

Cumulative impacts associated with socio-economic aspects are termed the "multiplier effect". The multiplier effect of socio-economic impacts and benefits of the Sasol Mining: Middelbult – Block 8 – Shondoni project within the greater Secunda Area, and to a lesser degree also further and beyond the local area itself, is significant. In view of the Development Goals for South Africa, job creation is certainly assessed to be one of the most important drivers for socio-economic upliftment, aimed at providing a better life for all. In this regard alone, Sasol Mining contributes a vast number of employment opportunities, the multiplier effect of which is far beyond significant.

Environmetal Management Plan

Chapter 7 along with C hapter 8 of the EIAR es sentially represents the Draft Environm ental Management Plan (EMP) required by the authorities.

Management Objectives used for Measures Design

The Management Measures have been conceptualized, designed and commissioned to achieve certain Management Objectives.

Management objectives are two fold in nature, namely:

- Attainment of Formal Compliance (legal compliance)
- Attainment of Materia l Com pliance (technical compliance which could b e qualitiative/generic (prevent im pact, minimize impact, monitor impact) or quantitative (measure against guidelines/emission standards/water quality objectives, etc.)

The Form al Com pliance required at Middelbul t – Block 8 – Shondoni ha s been dealt with extensively in the Env iro-Legal Framework compiled for the site for both existing, as well as for proposed new activities, and in which all licenses, perm its and other authorizations which are legally required have been identified a nd discussed – section 4.2 in VOLUME I of this submission.

As far as Material Compliance is concerned, guidelines and com pliance conditions/standards have been identified b y the sp ecialists to be applicable to th e various environm ental components, and which were considered for th e design of m anagement m easures for all the project life cycle phases including the plan ning and design phase, construction phase, operational phase, decommissioning and closure phase, as well as the post closure phase. These are detailed in section 7.1 of the EIAR.

Management objectives exist in various for mats and are available to differe nt levels of detail and sophistication. For aspects related to wa ste management, water m anagement, air quality management and noise m anagement, guidelines and objectives are clear and well defined, whilst for as pects such as soils, p lant life, anim al life, heritage and visu al aspects, ob jectives are less well defined and som etimes even non- existent. However, for this project, each specialist w ho was invo lved in designing the environm ental m anagement plan, used his own discretion and expertise to acco mmodate the various levels of objectives in the conceptualization and design of the proposed management measures.

Measurable com pliance standard s for critical environmental m anagement m easures such a s for instance surface water and g round water quality m anagement, will b e con tained as compliance conditions in the various permits and licenses to be issued by the authorities.

Proposed Management Measures

The selection, design and im plementation of pr oposed m anagement m easures for Middelbult – Block 8 – Shondoni should comply with the ex isting guidelines listed in the previous section, should be according to current best practice and shoul d be in accordance with the BPEO (Best Practicable Environmental Option) principle.

This document represents a combination of the previous Environmental Management Plans for Middelbult and Block 8 (Original Middelbult EMPR appoved in 2002, and Block 8 EMPR Addendum approved in 2003), with a Draft Environmental Management Plan for the proposed new Shondoni Operations. Although, therefore, the existing operations are beyond the construction phase, and in fact some of which have already been decommissioned and closed, the Managment Measure Tables provided hereafter, will nevetheless include their contruction phases, as it did in the original EMP's compiled for these activities.

However, for the newly proposed activities related to Shondoni, all life cycle phases are relevant and therefore the **planning and design** phase, as well as the construction phase, operational phase, decommissiong and closure phase and the post closure phases are relevant.

Planning and design phase measures play a big role at Sasol Mining in Secunda. For Shondoni, various alternatives were considered in the planning phase for site selection, conveyor route selection, technology selection and mining method selection. Effective environmental control was a paramount consideration during the design of the conveyor system (noise, dust and spillage control) as well as during design of the ground water and surface water management measures, which included aspects related to detailed mine planning, careful selection of increased extraction sections, placement of overburden berms at shaft areas, as well as the dedign of PCD liner systems.

In conclusion it can therefore be stated that all proposed Environmental Management Measures for Middelbult – Block 8 – Shondoni, relate to current best practice, comprising practical measures most of which are currently being employed by Sasol Mining in the effective management of underground coal mining related impacts.

Environmental Management Plan (Tables)

Management Measures Tables have been compiled for each of the Middelbult – Block 8 - Shondoni life cycle phases, namely construction, operation, decommissioning and closure, as well as post closure. Selected columns from the Impact Assessment Significance Rating Tables were used as basis for the compilation of the Management Measures Tables. The Tables were further expanded with columns to provide for the implementation and compliance and performance auditing of the measures, and therefore represent the integrated and summarized EMP (Environmental Management Plan) for the Middelbult – Block 8 – Shondoni underground coal mine.

NB! For more detailed descriptions of the management measures as they relate to specific environmental components, please refer to the Specialist Reports attached as APPENDICES in VOLUME IV of this submission.

The EMP Tables contain the following columns:

- Activity/Aspect Description and Legal Reference
- Impact Identification and Description
- Risk Level Before Mitigation
- Mitigatory Difficulty
- Mitigation/Management Objective
- Proposed Mitigation Measure
- Severity Total After Mitigation – C Number
- Risk Level After Mitigation

- Responsible Person
- Time Schedule
- Budget Quantum
- Budget Allocation
- Provisioning Method
- Compliance Audit
- Performance Assessment

The Tables are contained in section 7.3 of the EIAR.

Planning and Design Phase Management Measures

The entire purpose of conduction an EIA and compiling a Draft EMP prior to any project being constructed and commissioned, is to timeously identify potential environmental impacts and to pro-actively design measures that can be implemented during construction, commissioning and operation of any mine or plant.

The techno-economic study conducted for the Middelbult – Block 8 – Shondoni Project, the relevant details of which are contained in Chapter 4 – VOLUME I of this submission, optimized all the design elements of the mine with respect to environmental management. The extent of these pre-emptive design elements in the project, is further eluded to in the section on Consideration of Alternatives, Chapter 4 – VOLUME I. Similarly, the underground mine design incorporated the Water Management Mine Planning Tool developed for Sasol Mining some years back. This Design Tool is used to optimize the selection of High Extraction Panels with the view of minimizing ground water ingress into the mine.

Therefore, although the proposed Environmental Management Measures are listed in the Tables under headings for Construction Phase, Operational Phase, Decommissioning and Closure Phase and Post Closure Phase, all these proposed measures must be conceptualized and designed prior to entering any one of the phases. It should also be noted that for example for measures to be effective during the post closure phase, measures contemplated for instance for preceding phase, could become pre-requisites for the effective implementation of measures for later phases.

A separate listing of Measures is therefore not done for the Planning and Design Phase, as all measures proposed for the remaining four phases, need to be planned and designed in advance.

Emergency Action Plans

Emergency actions were considered for the following major bio-physical compomnents:

- Ground Water
- Surface Water
- Plant Life
- Animal Life
- Aquatic Ecosystems

From a ground water management perspective, no emergency action plans are required at Middelbult – Block 8 – Shondoni. The ground water monitoring system will provide early warning of any ground water quality related impacts.

Due to the relatively slo w manifestation times for ground water im pacts, sufficient reaction times will be available to implement any reactive measures.

For surface water, durin g the operational phase, a nd even after site reh abilitation h as been completed and the vegetation has been re-est ablished, periodic m onitoring of the surface water qua lity will be d one and emergency a ction plans will only b e r equired if signif icant volumes of polluted surface water is discharged into the natural environment.

To this effect it is nec essary to inspect the site on a regular routine basis (at least once a year) and also after heavy rainfall eq uivalent to at le ast the extr eme wet conditions in order to assess the c ondition of the s ite and of any reh abilitated f acilities. W here ser ious er osion or spillages are noted the appropriate remedial actions must be taken to ensure that such eros ion or spillages do not occur again.

However, should a significant volume of polluted surface water be discharged to the receiving environment it is im perative th at th e immediate downstream users of t he Surface Drainage Features be notified of such an event in order th at appropriate actions can be taken to mitigate such an event i.e. diversion and containm ent of t he contam inated surface water in a suitab le location.

For Plant Life, Ani mal Life and Aquatic Ecosys tems the m ain em ergencies als o relate to spillages of harmfull substances during the operation of the Shaft Areas and Conveyor Routes. In the event of a spill, m easures to contain the sp ill and re duce the area affected should be initiated as soon as possible. Spill containment kits should be m ade perm anently available and the relevant pers onnel trained in the use of th e kits. Once the spill is under control m easures to remove contam inated m aterial m ust be initiate d immediately. All contaminated soils must be disposed of at a suitable waste disposal site.

If any surface water features are contam inated or if it is expected th at they hav e becom e contaminated, immediate sampling and analyses of the water should take place to identify the extent and severity of the contam ination. The Department of W ater A ffairs should also be immediately notified.

If it is expected tha t th ere will be a signif icant im pact on the f loral, f aunal or aq uatic and riparian community, it must be ensured that an aquatic ecological assessment is undertaken as soon as possible by a suitably qualified aquatic ecologist. The scope of any such assessm ent should be defined in collaboration with the aquatic ecologist.

If any fires break out, the fire m ust be controlled in such a way as to prevent an impact on the wetlands and riparian zones.

Implementation Protocol and Schedule

The implementation schedule for all proposed m anagement measures, during all the life cycle phases, are indicated in the Managem ent Measure Tables. Most of the measures proposed in the EMP, will b e re levant to th e co nstruction p hase and as such they are m ostly part a nd parcel of the facility design as required for construction.

In general the implementation protocol would follow the following sequence:

- Identify the relevant activity.
- Verify the Impact Risk Rating and prioritize accordingly.
- Assess all measures required during all the life cycle phases of the specific activity.
- Confirm that the required authorization for the activity and/or measure has been obtained – if not start application.
- Confirm that the engineering design for the activity and/or measure has been completed and approved by the regulating authority.
- Obtain approval for the financial expenditure.
- Tender, if required, and appoint contractor.
- Construct.
- Commission.
- Operate.
- Monitor efficiency.

Application of the Construction Phase, Operational Phase and Decommissioning Phase implementation protocols, is the responsibility of the designated Environmental Manager for Middelbult Colliery. Post Closure, it becomes the responsibility of the Sasol Mining Group Environmental Manager.

EMP Compliance Monitoring and Reporting

The EMP Tables also contain columns to assess compliance with the implemention protocol and schedule, as well as to audit the efficiency of the proposed management measures. The time frames for compliance assessment and auditing, which are determined largely by the length of the specific life cycle phase, are also given in the EMP Tables.

Commitments and Financial Provisioning

Environmental Management Commitments

Overall Environmental Management Commitments are entrenched in the SASOL Safety Health & Environmental Policy, a copy of which is shown in Figure 7.7.1(a) in the EIAR.

Environmental Compensation Protocols

Sasol Mining has a Standard Operation Procedure to investigate complaints and/or claims from parties who claim to be affected, to assess the degree of influence caused by its mining activities on the environment, and to determine the format and quantum of compensation.

Calculation for Financial Provisioning

The calculation for financial provisioning for the implementation of Environmental Management and Closure Measures are done on a routine as well as project specific basis at Sasol Mining. In determining Financial Provision, Sasol Mining utilizes the "Guideline Document for the Evaluation of the Quantum of Closure Related Financial Provision to be Provided by a Mine".

The closure provision model is based on the fact that Sasol Mining is a coal mine and ranked as a medium risk in the abovementioned guidelines. The model was based on the detailed itemisation listed in Table 12 of the Guidelines and the associated costs required for premature closure. The worst case scenario was taken into consideration and therefore the associated factors were used.

The following items were excluded from the closure costs:

- No housing facilities will be provided on site,
- Middelbult Sasol Mining is an underground mine therefore it will not have any open cast activities that will require rehabilitation,
- From a previous groundwater specialist study undertaken by IGS it was depicted that the mine will not decant and, due to the characteristics of the coal, it will not generate acid either.

Taking the abovementioned into consideration, Sasol Mining will continue to evaluate their financial provision on an annual basis to ensure that unforeseen impacts omitted during the initial impact assessment will be included into the costing model.

The Financial Provisioning for the existing Middelbult Operations, as revised during November 2010, is attached as Table 7.7.3(a) in the EIAR.

The Financial Provisioning calculated for the Shondoni Project during November 2010, an amount in addition to that provided for the existing Middelbult Operations, is attached as Table 7.7.3(b) in the EIAR.

Mechanism to Provide the Funding

All capital expenditure during the Construction and Operational Phases are provided through CAPEX Budgets subject to Board approval.

Operational environmental costs such as maintenance and monitoring are funded through the annual operational budget of the Mine. These expenses are budgeted for, and approved on an annual basis as part of the Mine OPEX budget.

Funds required for Decommissioning and Closure for existing Middelbult Operations, as reflected in Table 7.7.3(a) in the EIAR are held in a Trust Fund.

Funds required for Decommissioning and Closure for the proposed Shondoni Project will eventually be deposited into a Trust Fund. For the moment a guarantee would be provided.

Environmental Awareness Plan

Section 39 of the MPRDA requires Sasol Mining to develop an environmental awareness plan to inform the employees of any environmental risks which may result from their work. In addition to this, environmental awareness training has been identified during the EIA process as a mitigatory measure to prevent and minimise impacts on the receiving environment.

Sasol Mining recognises the role of the environmental awareness plan in preventing and minimising its impacts from mining operations on the environment.

Therefore the objectives of the environmental awareness plan will be:

- To educate em ployees regarding their role in conserving the environm ent and the importance of conserving natural resources,
- To identify environmental training needs for employees and contractors at all levels,
- To ensure that em ployees whose work could cause significant environmental impact as identified by the mine are competent to perform those tasks to which they are assigned,
- To enable employees to identify environm ental i mpacts or non-conform ances of t heir work activities on the environment,
- To familiarise employees with emergency preparedness and response requirements.
- To be aware of the potential con sequences o f deviation from specified operating procedures, and
- To conduct their work and m anage mining activities in an environm entally responsible manner.

Training Needs Analyses

A needs analysis for environm ental awareness has been compiled as part of the IS O 14001 Environmental Management System – Table 7.8.1(a) in the EIAR.

Induction Training Requirements

All new employees and contractors who will be doing work on the m ine wi ll undergo induction training. It is therefore suggested that basic environm ental training should for m part of this training. All existing an d new e mployees will u ndergo annual induction training when they need to renew their Red Ticket and undergo an annual medical check up. The induction training will be a br oad introduction to what the e nvironment is and the reasons why it is important to conserve the animals, plants, water and other natural resources.

The training will include topics but shall not be limited to the following:

- What activities can impact on the environment?
- Type of impacts associated with mining activities,
- Employees' responsibility and role in conserving the environment,
- Actions that will be needed to prevent or minimise the impacts,
- Waste management,
- Water conservation, and
- Emergency response and preparedness procedures.

Other Training Requirements

Once the employees are trained in the basic envi ronmental aspects more detailed training will be provided on other aspects as they becom e required but could include but shall not be limited to:

- Waste Management (recycling, reusing),
- Spill kit training, and
- Conservation of natural resources (water, electricity, oil).

This train ing will b e a pplicable to em ployees working in area s wher e thes e top ics ar e of importance.

Awareness Training

Awareness training of employees will be conducted featuring different environmental topics on a monthly basis. These topics will be discussed at their toolbox talks, shift meetings and posted on the notice boards for everyone to see.

These topics will summarise an issue and/or an incident that occurred during the previous month, e.g. the pollution control dam overflowed due to poor housekeeping and maintenance. This method will also be used to disseminate information at the grass root level in an effective and sufficient manner.

Frequency of Training

The frequency of training will be determined by the need for continues training. It is proposed that all employees will be scheduled for annual induction training. Other training will be conducted on a n ad hoc basis, which will be determined by the need for specific training, e.g. spill kit training will be conducted when a new spill response team is appointed.

High awareness regarding the environment among employees will be sustained through the use of monthly environmental topics. These topics could summarise themes from the induction training, or it could be based on the normal seasonal trends such as dry periods and the conservation of water and prevention of fires.

Environmental Monitoring

A comprehensive Environmental Monitoring Plan has been designed for Middelbult – Block 8 – Shondoni. The plan is detailed in Chapter 8 of the EIAR. The following environmental aspects will be monitoried in this structured monitoring programme:

- Topography
- Soils
- Ground Water
- Surface Water
- Plant Life
- Animal Life
- Aquatic Biomonitoring
- Noise

Environmental Impact Statement

A com prehensive Environm ental Impact Asse ssment was conducted for various relevant activities at Sasol Middelbult Shondoni. The activities assessed included the following:

- NEMA Listed Activities as listed in GNR 386 and GNR 387.
- NWA Water Uses listed in Section 21 of the NWA.
- NWA Exemptions from GNR 704.
- NEMWA Waste Activities listed in GNR 718.
- MPRDA Environm ental Im pacts listed for Sh ondoni shaft and all current operational and closed shaft complexes.
- MPRDA Environm ental I mpacts listed fo r Middelbult Shondoni underground m ining activities.
- MPRDA Environm ental Im pacts listed for Middelbult Shondoni conveyor belt commissioning and operation.

The EIA conducted is of high integrity with a very high degree of confidence, mainly due to:

- Comprehensive base line stud ies were conducted by a team of specialists for the following aspects:
  - Topography (described by various specialists in other specialist reports)
  - Soils
  - Land Capability and Land Use (part of soils report)
  - Geology
  - Ground Water
  - Surface Water
  - Plant Life
  - Animal Life
  - Wetlands
  - Aquatic Ecosystems
  - Air Quality (basic r eference to impact due to constru ction and operational activities)
  - Noise
  - Visual Aspects
  - Heritage assessment
  - Socio Economics (references m ade to th e comprehensive Social and L abour Plan, compiled by Sasol Mining).

- The base line studies provided detailed, site s pecific quan titative descriptions of the current and future situation at Sasol Middelbult Shondoni.
- Detailed pr oject and p rocess des criptions f or all existin g activ ities, as well as f or proposed new activities Sasol Middelbult Shondoni, were availa ble that could be used to identify impacts.
- The same specialists that conduc ted the base line studies, pe rformed detailed empirical, analytical, numerical and stochastical m odelling to support the im pact assessments for various critical environmental components.
- A formal numerical impact significance assessment matrix, based on the Sasol Mining Protocol was then used to assess th e impacts associated with all the identified activities, for all four life cycle phases of the various activities.

- The numerical impact significance assessment matrix considered the following criteria:

  - Quantity of the impact
  - Toxicity of the impact
  - Extent of the impact
  - Duration of the impact
  - Environmental Status of the impact
  - Legislation required for the impact
  - Impact on Interested and Affected Parties

- Based on the num erical rating obtained, im pact significance was dete rmined to f all in one of the following four possible outcomes:

EXPLANATION FOR IMPACT SIGNIFICANCE RATING		
Criteria	**Definition**	**Points obtained from Sasol Mining rating system**
Impact Magnitude or Significance		
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 counteract the impact, or mitigation is difficult, expensive, time-consuming or a combination of these. Social, cultural and economic activities of 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.**	**17-22**
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.**	**10-16**
Low	**Impact is of a low order and therefore likely to have 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.**	**5-9**
No Impact	**Zero impact.**	**<5**

Summary of Key EIA Findings

The key findings of the Impact Assessment will be discussed with reference to the Impact Significance Categories listed above, for each of the project life cycle phases.

Construction Phase

This phase at Sasol Middelbult Shondoni will consist of the commissioning of the following infrastructure:

- Construction of the Shaft Complex at Shondoni.
- Construction of associated infrastructure at the Shondoni Shaft, namely:
  - The Coal throw out stockpile.
  - Service Water Dams and Storm Water Pollution Dam.
  - Diesel Fuel Storage Tanks.
  - Construction of an Access Road to the Shaft.
- Construction of a double circuit 132 kV Overhead Power line from Eskom.
- Construction of an overland conveyor system from the Shaft to the SSF facility.

For the 11 environmental components assessed for the construction phase, the highest negative pre-management impact significance was assessed as **medium,** all of which could be managed to **low**.

Components, for which **medium** negative impact significance was assessed, included:

- Soils
- Land Capability and Land Use
- Surface Water
- Plant Life
- Animal Life
- Wetlands
- Aquatic Ecosystems

The most critical impacts that needs to be managed, relate to

- the disturbance of soils (at the shaft complex)
- the impact on aquatic ecosystems at conveyor belt river crossings

The construction phase assessment for socio-economic impacts, indicated a **medium positive impact**. This positive impact relates to capital expenditure which will flow into the private sector through appointment of external contractors and suppliers during the construction of the various activities.

Operational Phase

The impact assessment for the operational phase was conducted with the assumption that the measures listed would be implemented during the construction phase and managed and maintained during the operational phase. Impact significance ratings for the operational phase varied between **low** and **high**.

Whereas for most of the environmental components impacts can be managed down to **low** levels of significance, the potential for impacts to remain at a **medium** significance level, if dedicated management is not performed, remained for the following environmental components:

- Topography
- Soils
- Ground Water
- Surface water
- Plant Life

The **medium** significance rating in all instances relate primarily to the **long duration** of these impacts, (full operational phase) and not necessarily to the **intensity** of the impacts. The most critical impacts that need to be managed are:

- Surface subsidence due to increased extraction activities
- The pollution of sub-soils from the coal stockpile and Pollution Control Dam
- Reduction in ground water base flow due to increased extraction activities
- Deterioration in ground water qualities stored in underground compartments
- Surface water management of underground water, in the event that insufficient storage space is available underground.
- Invasion of alien plant species

All the above components need to receive dedicated attention during the operational phase, in order to manage them down to a **low** significance.

Decommissioning and Closure Phase

The decommissioning and closure phase essentially represents a construction phase in reverse. The cause of impacts, as well as their intensity and duration are very similar to that observed for the construction phase.

Impacts of **medium** significance, but all of which can be managed to **low** significance, have been assessed for the following environmental components:

- Topography
- Surface Water
- Plant Life
- Aquatic Ecosystems

The most critical impacts that need to be managed are:

- Residual surface subsidence due to increased extraction activities (very low likelihood)
- Surface water management of underground water, in the event that insufficient storage space is available underground.
- Invasion of alien plant species

Similar to the construction phase, the decommissioning and closure phase assessment for socio-economic impacts, indicated a **medium positive impact**. This positive impact relates to capital expenditure which will flow into the private sector through appointment of external contractors and suppliers during the decommissioning (de-constructi on) of the various activities.

Post Closure Phase

Impacts that persis t post closure are referred to as res idual impacts and will of cour se only occur if such impacts had indeed manifested during any of the pre-ceding phases.

Impacts of **medium** significance, but all of which can be m anaged to **low** significance have been assessed for the following environmental components:

- Topography
- Ground water
- Surface Water
- Plant Life
- Aquatic Ecosystems

The most critical impacts that need to be managed are:

- Residual surface subsidence due to increased extraction activities (very low likelihood)
- The storage and treatment of polluted underground water.
- Preventing/Managing inter-mine flow.
- Surface water m anagement of underground water, in the event that insufficient storag e space is available underground.
- Invasion of alien plant species at closed areas (shaft and conveyor).

Comparative Assessment (Positives/Negatives)

This EIA/E MP was conducted to obtain authoriz ation for essentially the expansion of the existing Middelbult Mine into the Block 8, Springbokdraai, Leeu wpan and Block 8 Northern Reserves. This expansion would extend the life of mine of Middelbult Colliery up till 2041, at an annual p roduction rate of between 8.5 and 9. 5 m illion tons. It is therefore quite obvious that this expansion would optimize the reserve utilization for Middelbult Colliery.

The coal produced by Middelbult – Shondoni contri butes a significant portion of the critically required feed into the Sasol Synf uels Plant at Secunda. The sust ained maintenance of the coal mining production rates to source the SSF Plant is of the utmost importance.

Sasol Synfuels in Secunda arguabl y represents one of the single most strategic ind ustries in South Africa. W ithout quoting figure s, it is obvious that its contribution to the supply of the national liquid petroleum, industrial chem ical and agricultural chem ical markets, to nam e but a few of the more obvious, is of national strategic significance.

The exiting Middelbult Mine has contributed to the South A frican GDP since the 1990's. The expansion of the Middelbult m ining operations into the Block 8, Springbokdraai, L eeuwpan and Block 8 Northern Reserves will contribute signi ficantly to the GDP. Estim ates in 2003, puts a shaft development cost, similar to what is envisaged at Shondoni, at an estimated R 900 million. The annual expense budget estim ated in 2003, puts annual ex penditure during full production at some R 700 million per year.

Although none of the Middelbult Shondoni coal will be sold directly into the foreign markets, the indirect contribution to the South African Balance Sheet is obvious due to the significant contribution to the local econom y via the Sasol Synfuels contri bution to fuel and chem icals supply.

Middelbult - Block 8 - Shondoni), as part of th e overall mining and industrial industry in the Govan Mbeki Municipal Area, contributes qu ite significantly to the socio-econom ic wellbeing of the region. Studies conducted in the area clearly show the dominant contribution of the m ining and associated industrial sectors to the socio-econom ic fabric of the area. The influence of the m ining and industrial sector s clearly m anifest in asp ects related to ag e distribution, employment, income and the provision of services and housing.

The number of people employed in the Govan Mb eki Municipality amounts to some 67 172 people (or 32 % of the total population). Not reflected in these figures is the amount of informal employment within the district. In a study conducted by DPR (2000), the num ber of people involved in the infor mal employm ent sector in the Highveld Ridge District was ±7 000.

Information available f or the v arious secto rs of the econom y and the num ber of people employed in these sectors, indicate that m ining accounts for the highest number of employees at 9,54% (20 018 people) followed by manufacturing at 4,35% (9 130 people).
However, these figures only reflect the direct employment in these sectors and do not account for the peripheral employment created around these sectors.

The Middelbult - Block 8 - Shondoni workforce of 1600 employees represents som e 8 % of the total mining sector workforce in the area.

Against all these positive im pacts associated with the Middelbult expansion, weighs the negatives of the expected environm ental impacts. The high ly quantitative impact assessment conducted, however, indicated all expected environm ental im pacts to be m anageable to acceptable levels. The m ethodologies and techn ologies required to m anage these impacts, all represent proven existing best practice interventions, as have been employed by Sasol Mining for a number of years now.

The extent to which Sa sol Mining has incorp orated env ironmental m anagement menasures into their planning and design phase for this project, bears clear testim ony to their commitment towards protecting the environm ent through sustainable m ining program s in a responsible manner.

The conclusion is therefore reached that the positive impacts associated with this proposed project, exceed the negative impacts by quite a large margin.

Professional Opinion for Authorization

Recommendation for Approval

Based on the outcom e of the high integrity imp act asses sment there appears no scien tific evidence that environm ental impacts associated with the pro posed activities of Sasol Mining at Middelbult – Blcok 8 – Shondoni will result in impacts of unacceptable magnitude and risk.

All impacts identified for all th e life cycle phases of the project, can i ndeed be fully managed to acceptable levels usin g existing b est practice methodologies. In this regard Sasol Mining, through their innovative design of mining infrastructure, as well as underground m ining plans and water m anagement plans, has dem onstrated their full capacity and commitment towards managing their coal mining related impacts to acceptable levels.

It is therefore recommended by the EAP that approval be granted to Sasol Mining (Middelbult Colliery), to proceed with the activities as applied for, subject of course to conditions as could be specified by the relevant regulatory authority(ies) within their respective mandates of regulation.

Conditions for Approval

Conditions for approval remain the prerogative and responsibility of the relevant regulatory authority. However, the Recommendation for Approval of the EAP is made subject to the following conditions:

- That the Environmental Management Plan as detailed in the Management Measure Tables, be implemented as proposed, or alternatively with motivated alterations.
- That ongoing monitoring and auditing, also as proposed in the EMP (Chapter 7 and Chapter 8) be conducted during the life span of the project.
- That environmental management measures be adapted, or continued, based on the outcome of the monitoring and auditing programmes.

Respectfully submitted

Original Signed By

_____

Jasper L Muller (Pr.Sci.Nat.)

Prj54591

1. INTRODUCTION

Sasol Mining operates a number of underground coal mines in the Secunda Area. Middelbult Colliery represents one of the underground mines and has been in operation since 1981. During its existence Middelbult Colliery has gone through several expansions. Whilst some of the original shafts have already been closed and rehabilitated, new shafts have been developed to access coal within the larger Middelbult Reserves.

As part of this on going development to ensure access to exploitable reserves, Sasol Mining is now investigating options to replace the existing West Man and Materials Shaft with a new Man and Materials Shaft (Shondoni) in the Block 8 reserves in order to increase its reserve utilisation of the existing Middelbult operations (original Middelbult Reserves and Block 8 Reserves). At the same time the current mine lease area is also extended to now include the Block 8 Northern Reserves, the Springbokdraai Reserves and the Leeuwpan Reserves.

The proposed expansions require Environmental Authorisations. As part of this, potential environmental impacts must be assessed and the Environmental Management Plan (EMP) must be amended in terms of the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA). In order to achieve this, the current Environmental Impact Assessment (EIA) and Environmental Management Programme Report (EMPR) approved under the Minerals Act (Act 50 of 1991) must be amended.

Additionally, an Environmental Authorisation is required in terms of the National Environmental Management Act (NEMA) (Act 107 of 1998) for all listed activities related to the proposed expansion whilst an Integrated Water Use License Application (IWULA) is also required in terms of the National Water Act (NWA) (Act 36 of 1998) to authorize water uses related to the expansion. A waste license application to authorize the sewerage works at Shondoni in terms of the National Environmental Management Waste Act, Act 59 of 2008, is also required.

The proposed infrastructure expansion of the Middelbult operations, comprise one additional man and material shaft complex (Shondoni Shaft) with associated infrastructure in the Block 8 Reserves and a new overland conveyor to convey the coal to an existing conveyor in the south which will transport the coal to the Sasol Mining central coal stockpile area (Sasol Coal Supply or SCS), and of course the underground workings for the additional reserve blocks (Block 8 Northern Reserves, the Springbokdraai Reserves and the Leeuwpan Reserves).

The proposed future mining activities will be conducted by means of underground mining operations, utilising the bord-and-pillar and high extraction methods to extract coal from the No.4 and No.2 Coal Seams. It is anticipated that approximately 8.5 to 9.5 million tons of coal per year will be mined.

The increased utilisation of coal reserves will mean that Middelbult (Block 8) will continue mining (current schedule) for an additional 3 to 4 years. The long-term plan for Middelbult-Shondoni is to maximise its life thereby ensuring optimal coal reserve utilisation.

Since its inception in 1981, Middelbult Colliery has applied for, and has obtained approval for an EMPR (applied in 2001) as well as an EMPR Addendum (applied in 2003 for Block 8) in terms of the provisions of the old Minerals Act.

The intention of this current EMPR Addendum and EIA/EMP is to combine all the previous work done at Middelbult Colliery into one single integrated document which will represent the overall comprehensive Environmental Impact Assessment and Environmental Management Plan for Middelbult Colliery, including all new, as well as historic Shafts, Conveyors and Mining Operations, but now in compliance with the requirements of both the MPRDA as well as NEMA.

However, a clear distinction will be made in the report to separate all activities already authorized and new activities for which authorization are currently sought.

Figure 1(a) shown below, puts the project into an authorization time line perspective. The current Middelbult-Block 8 mine lease boundary is indicated with the **red** line.

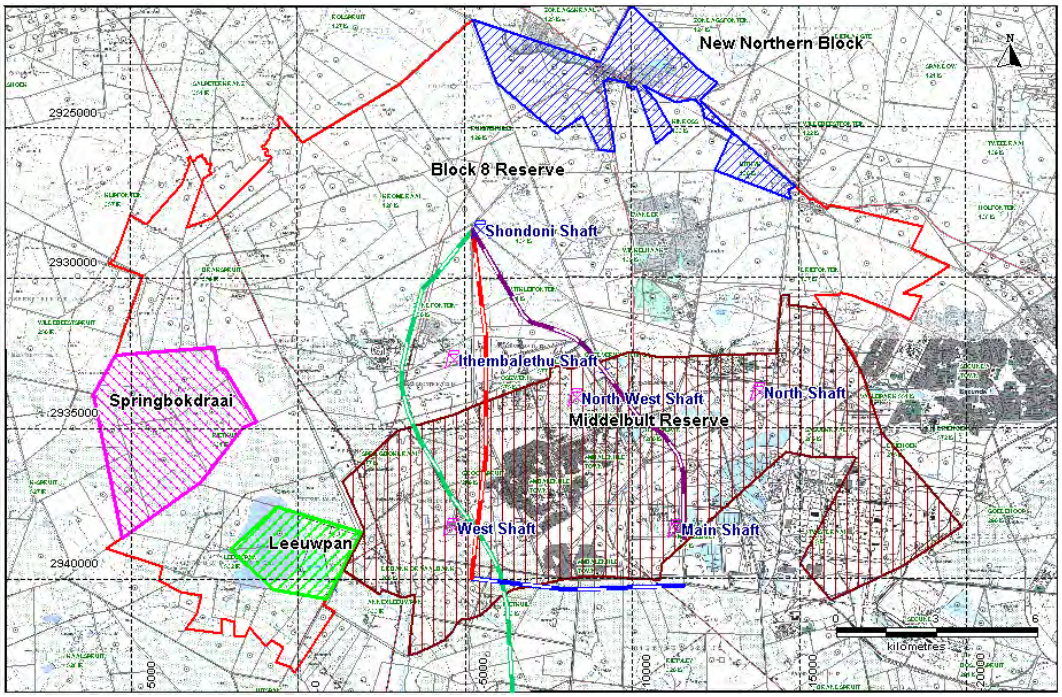


Figure 1(a): Middelbult-Block 8-Shondoni Project Area

The area highlighted with **brown vertical lines**, represents the original Middelbult Colliery area for which an EMPR was submitted to the DME **in 2001 and which was approved in 2002**. The approval included the highlighted Underground Mining Area (both the No.2 Seam and the No.4 Seam), the four shafts, Main Shaft, North Shaft, West Shaft and North-West Shaft, as well as the Coal Conveyor from the Main Shaft to the Sasol Central Coal Stockpile Area. Both North Shaft as well as North West Shaft have been decommissioned and closed and are not active any longer.

The area within the **red line** and which is not highlighted, represents the Block 8 EMPR Addendum which was submitted **in 2003 and approved in 2004**. This approval includes the Underground Mining on the No.2 Seam and the No.4 Seam within this area, as well as the Ithembalethu Shaft and Satelite Ventilation Shaft.

The **current application** therefore relates to the additional man and material shaft indicated as Shondoni Shaft and its associated infrastructure, the **green** coal conveyor belt from the Shondoni Shaft towards the south where it joins up with an existing conveyor belt, as well as the Underground Mining on the No.2 Seam and No.4 Seam for the areas highlighted in **green** (Leeuwpan Reserves), **magenta** (Springbokdraai Reserves) and **blue** (New Northern Block Reserves).

2. THE NEMA AND MPRDA EIA PROCESSES

2.1 INTRODUCTION

With effect from 3 July 2006, the listed activities and authorisation process promulgated in terms of the National Environmental Management Act 107 of 1998 (NEMA), commenced (**save for those listed activities in respect of mining which will commence at a date to be published**) and the relevant notices promulgated in terms of the Environment Conservation Act (ECA) (Act 73 of 1989) pertaining to identified activities and the Environmental Impact Assessment (EIA) Regulations have been repealed.

Section 24 of the NEMA, headed "Environmental Authorisations" sets out the provisions which are to give effect to the general objectives of Integrated Environmental Management (IEM). In terms of section 24(1), the potential consequences for or impacts on the environment of *inter alia* listed activities must be considered, investigated, assessed, and reported on to the competent authority and/or the Minister of Mineral Resources, except in respect of those activities that may commence without having to obtain an environmental authorisation in terms of the NEMA.

Accordingly, the listed activities have been promulgated in two different government notices, namely Government Notice R. 386 in Government Gazette No. 28753 of April 2006 (GNR 386), which identifies those activities for which a Basic Assessment must be undertaken in accordance with the procedure set out in regulation 22 to 26 of GNR 385, and Government Notice R. 387 in Government Gazette No. 28753 of 21 April 2006 (GNR 387), which identifies those activities for which a Scoping and Environmental Impact Assessment must be undertaken in accordance with the procedure set out in regulations 27 to 36 of GN R. 385.

The Schedules to both GNR 386 and GNR 387 set out those activities that have been identified in terms of section 24(2)(a) and (d) of the NEMA which may not commence without environmental authorisation from the competent authority and for which the investigation, assessment and communication of potential impacts of the activities must follow the procedure described in regulation 22 to 26 of the regulations in respect of those activities that require a "Basic Assessment" or in terms of Regulation 27 to 36 of the regulations in respect of those activities that require "Scoping and Environmental Impact Assessment".

This application for Middelbult Shondoni is an application *inter alia* in terms of section 24 of the NEMA referred to above, read with GNR 385 and in particular the application for **Scoping and Environmental Impact Assessment** described in regulations 27 to 36. Various listed activities in both GNR 386 and GNR 387 will be undertaken in order to give effect to the project and these have been identified and listed in the application that will be submitted to the Department of Economic Development, Environment, and Tourism (DEDET).

However, in view of the fact that listed activities related to mining have not yet become part of the application to DEDET, these activities must be authorized by DMR in terms of the provisions of the MPRDA and the MPRDA Regulations GNR 527, which similarly also requires both the Scoping and EIA processes.

The di agram b elow, Figure 2.1 (a), illustrates t he pr ocesses f or bot h a Basic Assessment, and a Scoping and Environmental Impact Assessment. As described in Section 2.1, various listed activities in both GNR 386 and GNR 387 have been identified for the Middelbult Shondoni Project and will be incorporated into one Scoping and Environmental Impact Assessment Process for this project.

However, the same EIA process will also be followed to give compliance with the requirements of the MPRDA Regulations, save that a formal application does not have to be lodged with DMR.

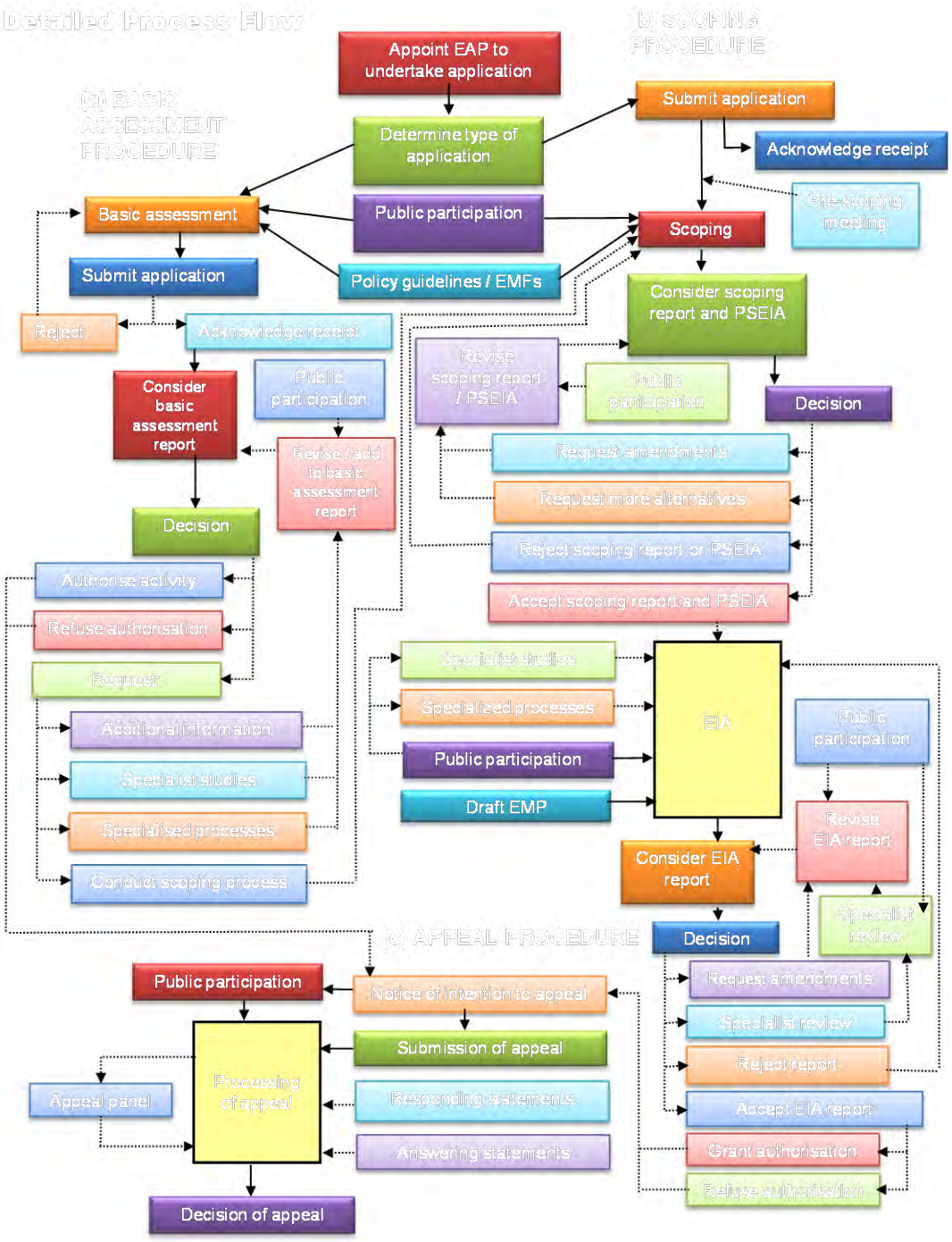


Figure 2.1(a): Combined NEMA and MPRDA EIA Process Flow Diagram

2.2 DETAILS OF AND DECLARATION BY THE EAP

The EIA and associated EMP for this project was compiled by fully qualified and duly registered Professional Scientists and Engineers. Synoptic CV's of all personnel which contributed to the project, are attached in APPENDIX 2.2(A) to this report.

The duly appointed **EAP for the Project is JMA Consulting (Pty) Ltd**. JMA Consulting has in-house qualified experts in a number of specialist environmental disciplines. For the remainder JMA sub-contracted the services of the following Professional Consultancies and Certified Laboratories for specialist inputs into the project:

Sub-Consultancies

Dr Julius CC Pistorius Archaeological and Heritage Management Consultant
Acusolv Acoustic Consulting Engineers
Geostratum CC
Jones & Wagener (Pty) Ltd
Wetland Consulting Services
Earth Science Solutions
BKS Group (Pty) Ltd.

Laboratories

Yanka Laboratories

Table 2.2(a): Details of Project Consultancy

Project Consultancy:	JMA Consulting (Pty) Ltd
Company Registration:	2005/039663/07
Professional Affiliations:	South African Council for Natural Scientific Professions
Contact Person:	Mr Jasper Müller (Pr.Sci.Nat.)
Physical Address:	15 Vickers Street DELMAS 2210
Postal Address:	P O Box 883 DELMAS 2210
Telephone no:	+27 13 665 1788
Fax no:	+27 13 665 2364
E-mail:	jasper@jmaconsult.co.za

2.2.1 Details and Expertise of the Principal EAP

The principal Environmental Assessment Practitioner on the Middelbult-Shondoni project is Mr Jasper L Müller (Pr.Sci.Nat.). Jasper Müller holds a M.Sc. (cum laude) in Geohydrology from the University of the Free State and has been active as an earth scientist and environmental scientist since 1986. He has, since 1993, been involved in the compilation of more than 200 EMPR's, EIA's, EMP's and IWWMP's.

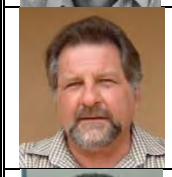
Jasper L Müller (Pr.Sci.Nat.)
(M.Sc. Geohydrology)

Jasper Müller is responsible for the overall project and specifically for EIA Process and Time Line Management, Project Technical Management (commissioning of specialist studies), and finally all the EIA/EMP Report Compilation including the full integration of all specialist study findings into the EIA/EMP.

2.2.2 Details and Expertise of the EIA and EMP Design Team

The following Scientists and Engineers were directly (specific inputs into this project) and indirectly (inputs incorporated from previous studies) involved with the Environmental Impact Assessment and Design of the Environmental Management Plan for this project:

Photo	Name Qualification Registration	Consultancy	Responsibility
	**Jasper Muller** **M.Sc.** **Geohydrology** **Pr.Sci.Nat.**	**JMA Consulting**	**Principle EAP** **EIA/EMP Documents** **Water Use License** **Waste License**
	**Jaco van der Berg** **M.Sc.** **Geohydrology** **Pr.Sci.Nat.**	**JMA Consulting**	**Geology** **Ground Water** **Mine Planning** **Materials Balance** **Ground Water Balance**
	**Genevieve Cloete** **B.Sc.Hons.** **Environmental Sciences** **Pr.Sci.Nat.**	**JMA Consulting**	**GIS** **Visuals**
	**Shane Turner** **B.Sc. Hons.** **Geology** **Cand.Sci.Nat.**	**JMA Consulting**	**Geology** **Ground Water**
	**Riaan Fourie** **B.Sc.Hons.** **Environmental Sciences** **Cand.Sci.Nat.**	**JMA Consulting**	**Public Participation**
	**Johan Fourie** **M.Sc.** **Geohydrology** **Pr.Sci.Nat.**	**Geostratum**	**Geochemistry** **Geochemical Modelling** **Ground Water Modelling**
	**Ian Jones**	**Earth Science Solutions**	**Soils**
	**Chris Waygood**	**Jones & Wagener**	**Surface Water Balance**
	**Michael Palmer**	**Jones & Wagener**	**Surface Hydrology**

	**Dieter Kassier**	**Wetland Consulting Services**	**Plant Life** **Animal Life** **Aquatic Ecology**
	**Ben van Zyl**	**Acusolv**	**Noise**
	**Julius Pistorius**	**Dr JCC Pistorius**	**Archaeology/Heritage**
	**Dawid de Waal**	**BKS**	**Public Participation**

2.2.3 Declaration by the EAP

I, **Jasper Lodewyk Müller**, declare under oath that I:

- Act as the independent environmental practitioner in this application;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2006;
- Have and will not have no vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2006;
- Will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- Will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;
- Will keep a register of all interested and affected parties that participated in a public participation process; and
- Will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.

Signature of the environmental practitioner:

JMA Consulting (Pty) Ltd

Name of company:

11/01/2011

Date:

Signature of the Commissioner of Oaths:

11/01/2011

Date:

EUGENE VAN NIEKERK
KOMMISSARIS VAN EDE
(MRO - 9/1/8/2 DELMAS (AOS)
PRAKTISERENDE REKENMEESTER
SAMUELWEG 5
DELMAS 2210

Designation:

2.3 PROJECT EIA STAGE 1 – PRE-APPLICATION & APPLICATION

2.3.1 Appointment of EAP

The proponent, Sasol Mining (Pty) Ltd (Sasol Mining**)** formally appointed JMA Consulting (Pty) Ltd (JMA) on 22 July 2009 for the Sasol Mining Middelbult (Block 8) Shondoni Shaft Project. The terms of reference of JMA for this project were to obtain all environmental authorisations relevant to the project that includes the sinking of a new shaft and construction of associated infrastructure (e.g. access road, etc), the construction of a conveyor system to transport the coal from the new shaft bunker linking onto an existing conveyor to Sasol Coal Supply (SCS), and finally, the expansion of the mine lease area and associated mining plan for the area.

2.3.2 Determine Type of Application

JMA studied the terms of reference for the project and concluded that the environmental authorisations relevant to this project include:

- A Scoping and Environmental Impact Assessment (EIA) process (application to DEDET);
- An amendment must be made to update the current approved Environmental Management Programme Report (EMPR) (application to DMR), and
- An Integrated Water Use License Application (IWULA) (application to DWA), including applications for General Authorisations and Exemptions from GN 704.
- A Waste License Application to authorize the proposed Sewerage Plant at the Shondoni Shaft.

For the **Scoping and Environmental Impact Assessment** process as prescribed under the National Environmental Management Act, Act 107 of 1998 (NEMA) legislation, JMA investigated, and compiled, a list of all the potential activities, with regard to the project, that may trigger any one of the activities listed in the EIA Listing Notices, GN R. 386 & GN R. 387. This list of potential activities was discussed between representatives from Sasol Mining and JMA on 29 October 2009 during a technical meeting and was subsequently finalised. These activities are listed in **Section 3.2.3** of this document**.** These activities were also discussed with the Interested and Affected Parties (I&APs) during the Public Meeting held on 10 November 2009 at the Evander Public Library. The appropriate application forms were completed and submitted along with the Scoping Report to the Department of Economic Development, Environment, and Tourism (DEDET) in Ermelo.

An **Amendment** to update the current **EMPR**, a process as prescribed under the Mineral and Petroleum Resources Development Act, Act 28 of 2002 (MPRDA), is also required. This process includes the compilation of a Scoping Report, as described in the MPRDA Regulations, which is to be submitted to the Department of Mineral Resources, along with an EIA/EMP document, also described in abovementioned Regulations. No application forms are relevant to this amendment process as no new application for a mining or prospecting rights are included in the terms of reference for this project.

For the **IWULA,** a process prescribed under the National Water Act, Act 36 of 1998 (NWA), an Integrated Water and Waste Management Plan (IWWMP) will be compiled and the water use application forms will be completed and submitted for all of the relevant water uses that have been identified in terms of Section 21 of the NWA. The abovementioned water uses were identified by JMA and discussed with Sasol Mining during a technical meeting on 29 October 2009. The water uses were also scoped with DWA during a meeting held on 4 November 2009. These water uses were also discussed with all the I&APs present at the Public Meeting held on 10 November 2009.

The proposed Sewerage Plant at the Shondoni Shaft falls in the category of Listed Waste Management Activities that have, or are likely to have, a Detrimental Effect on the Environment – GNR Notice 718 of 3 July 2009, published in terms of section 19. of National Environmental Management Waste Act, Act 59 of 2008. The sewerage plant as designed with an estimated annual throughput of some 138 700 m^3, represents a Category B waste management activity in terms of GNR 718. From an authorization perspective **application must be made for a Waste License** and the process must be supported with an EIA and EMP as prescribed in NEMA. The appropriate Waste License application forms will be completed and submitted along with a Waste License Application Report to the relevant authority – in this instance, DEDET in Ermelo**.**

2.3.3 Authority Consultation

A number of Pre-Consultation meetings were held with the relevant authorities as part of the authority participation process in order to obtain the inputs and comments of the various departments that will be responsible for issuing of approvals, permits and/or licences.

The first of these meetings were held between members of JMA, Sasol Mining, and the **Department of Mineral Resources (DMR**) at the Mpumalanga DMR Regional Offices in Witbank on 12 October 2009. At this meeting, a presentation was given by Sasol Mining outlining the proposed project. During discussions were regarding the DMR's preferences with regards to the format of the documentation to be submitted, proposed streamlining of DMR authorisation processes with timelines for the other environmental authorisation processes that are required, and other authorities that DMR deem important to contact as well.

The second Pre-Consultation meeting was held between representatives of JMA, Sasol Mining, **Mpumalanga Parks Board and officials from DEDET** at the DEDET Offices in Ermelo, on 21 October 2009. During this meeting the EIA process was discussed and inputs from DEDET were obtained regarding preferences regarding format of documentation to be submitted, proposed streamlining of DEDET authorisation processes with timelines for other environmental authorisation processes, relevant application forms due to their department's name change, and other authorities that DEDET see as important to contact as well. Suggestions regarding extent, scope and method of Public Participation were also made by DEDET.

The third Pre-Consultation meeting was conducted with the **Department of Water Affairs**' Gauteng Region and Head Office on 4 November 2009 at JMA's Offices in Delmas.

During this meeting the IWULA process was discussed and inputs from DWA were obtained regarding preferences regarding format of documentation to be submitted, proposed streamlining of DWA authorisation processes with timelines for other environmental authorisation processes, relevant application forms due to their department's name change, and other authorities that DWA see as important to contact as well. Identified water uses were confirmed and aspects relevant to GNR 704 compliance and possible exemptions were discussed. The applicable water uses and exemptions to be applied for are listed in Section 3.2.3 of this report.

Other authorities such as the Department of Agriculture, Department of Health, and Department of Roads were invited to attend the Public Meeting which was held on 10 November 2009, at Evander Public Library. Follow up meetings will be held as and when required.

Once the EIA and EMP have been submitted, follow-up meetings will be held with the relevant authorities, as and when required, to support the authorization process. Authority meetings are also foreseen for the Water Use License Application as well as for the Waste License Application.

In addition to the meetings mentioned, two site visits were also conducted with the authorities. The first visit site was conducted with officials from Mpumalanga Parks Board on Friday 8 January 2010. The second site visit was conducted with officials from DEDET on Thursday 3 June 2010.

Full details on authority consultation, including meeting minutes, are given in the formal Public Participation Report which is attached as an Appendix in VOLUME IV.

2.3.4 Focus Group Meetings

A combined focus group meeting was held with farm owners within the mine lease boundary and with a representative from Brendan Village on Friday 19 March 2010. The main objective of this meeting was to discuss the alternative coal conveyor routes. Sasol Mining has regular scheduled meetings with representatives from Harmony Gold.

Full details on public participation and focus group consultation, including meeting minutes, are given in the formal Public Participation Report – see VOLUME IV.

2.3.5 Submit Applications

The relevant EIA application forms have been completed and were submitted concurrently with the submission of the Final Scoping Report to DEDET in Ermelo on 24 April 2010. The Final Scoping Report was also submitted to DMR in Witbank on the same date. Both Departments have acknowledged receipt of the Scoping Report and DEDET issued an acceptance of the Scoping Report and gave permission for the EIA process to continue – letter dated 25 May 2010.

The Water Use License Application to DWA and the Waste License Application to DEDET will be lodged separately from this EIA process.

2.4 PROJECT EIA STAGE 2 – SCOPING

As described in the DEAT Scoping Guideline Document, (Scoping, Integrated Environmental Management, Information Series 2; 2002), distributed by the, then, Department of Environmental Affairs and Tourism (DEAT), the scope of an environmental assessment is defined by the **range of issues and alternatives** it considers, and the approach towards the assessment that will follow it. Scoping is a critical stage in the Integrated Environmental Management (IEM) procedure, since it is an important tool for **involving the public** in the environmental assessment process, and for **structuring assessment** studies. IEM is an approach that integrates environmental considerations into all stages of the planning and development process.

Through scoping, the priorities of the environmental assessment are set. As an open and iterative process, it may continue throughout planning and assessment, depending on whether or not additional issues or alternatives are introduced or eliminated because of new information.

The terms of reference for the assessment phase will be based on issues and concerns raised during scoping. If issues are inadequately identified, the assessment will be of poor quality. A consequence would be further delays in decision-making while further environmental information is gathered and assessed. On the other hand, if insignificant issues are not excluded from the assessment process during scoping a great deal of unnecessary work and wasted resources can be expended.

Internationally there are slight variations from country to country in the approach to scoping. Typically, the procedural aspects of scoping are determined by the legal, policy and administrative requirements and guidelines within a particular jurisdiction. Those that have a stake in a proposed activity are provided with the opportunity to contribute to the scoping process. When effectively done, it will involve the relevant authority, the proponent, other authorities, as well as Interested and Affected Parties (I&APs) in discussions about the proposed activity and the issues raised. The process for the identification of project alternatives must be documented, as well as the criteria used to evaluate these alternatives. Such criteria would include social, economic, and ecological/biophysical issues.

Scoping is typically divided into three phases:

- Planning the scoping procedure;
- A process of stakeholder engagement to identify the key issues; and
- Reporting on the terms of reference for the next phase of the assessment.

Though scoping is described as a discrete step in the environmental assessment procedure, in practice the process of identifying the significant issues usually continues throughout the assessment process, as well as decision-making, detailed design, implementation and monitoring.

2.4.1 Background Information Document

A Background Information Document (BID) has been compiled for the Scoping Phase of the EIA and was distributed to all of the identified I&APs along with a comment sheet. This BID was also made available to I&APs attending the Public Meeting that was held on the 10th of November 2009 at Evander Public Library. Full details are given in the Public Participation Report.

2.4.2 Notification

Notification of all identified I&APs regarding this project was done via formal letter, press advertisements, and site notices that were advertised in the surrounding area adjacent to the mine. Full details are given in the Public Participation Report.

2.4.3 Compilation of Scoping Report and Plan of Study (Specialist Studies)

The Scoping Report and Plan of Study for the EIA/EMP phase of the project was compiled by members of JMA and made available for public review after the scoping phase Public Meeting was conducted. All comments and issues raised by I&APs have been incorporated into, and addressed in the Final Scoping Report which was duly submitted to the relevant authorities – DEDET and DMR.

2.4.4 Scoping Public Meeting

The Scoping Public Meeting was held on 10 November 2009 at 13:00 at the Evander Public Library, situated in Lisbon Street. Full details are given in the Public Participation Report.

2.4.5 Comments from I&AP's

All comments received from I&APs have been documented in an I&AP Comments Register, and were addressed in the Final Scoping Report.

2.4.6 Finalize and Submit Scoping Report and Plan of Study

Upon receipt of the comments, the Scoping Report and Plan of Study was finalized and was submitted to the relevant authorities (DEDET and DMR) for review and approval on 23 April 2010.

2.4.7 Authority Review & Decision

Both relevant authorities (DEDET and DMR) have reviewed the Scoping Report. DEDET issued a formal acceptance letter on 25 May 2010 and gave permission for the EIA process to continue. DMR indicated that the process represents an EMPR Addendum in terms of the MPRDA, and therefore that DMR is not required to issue a formal acceptance of the Scoping Report. JMA was informed telephonically by DMR that the process can continue. Full details are given in the Public Participation Report – attached as Appendix in VOLUME IV.

2.5 PROJECT EIA STAGE 3 – ENVIRONMENTAL IMPACT ASSESSMENT

2.5.1 Conduct Specialist Studies

In the *Integrated Environmental Management Information Series, Specialist Studies Guideline 4; 2002*, it is stated that it is important to note that not all EIAs have specialist studies. The requirement to undertake specialist studies depends on the outcome of the scoping process. For example, if all the issues that are raised during the scoping can be addressed with the available information, then it may not be necessary to proceed through the full EIA process. The issues raised in the scoping phase of an EIA which cannot be effectively addressed with the currently available information, form the basis for the terms of reference of specialist studies. These specialist studies are commissioned to provide the information necessary to respond to the key issues associated with the proposed project. Specialists are appointed to analyze the current situation and assess the various impacts in terms of their anticipated magnitude. The aim of the specialist study phase is to provide information on the positive and negative impacts associated with the project alternatives. The studies also present recommendations for mitigation actions that may either enhance potential benefits or minimize harmful effects. EIA is a process designed to facilitate and improve decision-making on development projects.

The role of the specialist in the EIA process is to:

(1) address issues raised during scoping, and
(2) provide sufficient information that can be used by decision-makers.

In most countries, especially in developing countries, there are no established decision-making frameworks or criteria. Specialists thus have a critical role to play in ensuring that decision-makers have sufficient information to make rational and informed decisions.

EIA practitioners draw on inputs from a range of traditional scientific disciplines for example social sciences, earth–, and life sciences. The main benefit of using science in this manner in EIA is that the interdisciplinary nature of the process provides an effective way of translating good theory into good practice. Interdisciplinarity is the open information exchange and linkages between various scientific disciplines. However, scientific interdisciplinarity in an EIA is not just a matter integrating scientific results in an environmental report. More importantly, it is the basis for applying scientific knowledge in innovative and fresh ways to identify, define, interpret, analyze, and solve environmental problems.

With the exception of the three new reserve blocks added to the Middelbult and Block 8 mine lease area (Block 8 Northern Reserves, Springbokdraai and Leeuwpan), as well as for certain sections of the conveyor routes, the entire Middelbult (Block 8) Shondoni Project area has been the subject of detailed base line studies and impact assessments conducted during the 2001 EMPR and 2003 EMPR Addendum compilations.

From a base line perspective it was therefore only deemed necessary to expand the existing descriptions to the **surface areas not previously covered**. From an impact assessment perspective, work related to the mine water balance was updated to include the new proposed mining areas, whilst specialist inputs were identified during the scoping phase to be required for the proposed shaft complex area and the conveyor belt.

The Plan of Study for this Project, was finalized based on the outcome of the Scoping Phase. The following base line and specialist studies listed in the Final Scoping Report and Plan of Study, have been ratified by DEDET in their acceptance of the Scoping Report and Plan of Study:

- A detailed Soils Study was conducted by Earth Science Solutions.
- A detailed Land Capability Study was conducted by Earth Science Solutions.
- A detailed Land Use Study was conducted by Earth Science Solutions.
- A Biodiversity Vegetation Study was conducted by Wetland Consulting Services.
- A Biodiversity Animal Life Study was conducted by Wetland Consulting Services.
- A Biodiversity Aquatic Ecosystems was conducted by Wetland Consulting Services.
- A Biodiversity Wetland Study was conducted by Wetland Consulting Services.
- A Surface Water Study was conducted by Jones & Wagener Consulting Engineers.
- A Geology Study was conducted by JMA Consulting.
- A Ground Water Study was conducted by JMA Consulting.
- Visual Aspects related to the new Shondoni Shaft infrastructure as well as the proposed Coal Conveyor system, were assessed by JMA Consulting.
- Noise Aspects related to the new Shondoni Shaft infrastructure as well as the proposed Coal Conveyor system were assessed by ACUSOLV.
- Heritage Aspects related to the new Shondoni Shaft infrastructure as well as the proposed Coal Conveyor system, were assessed by Julius Pistorius Heritage Consultant.
- An Iterative Mine Planning Study to optimize surface water and ground water management was conducted by J&W and JMA in collaboration with Sasol Mining.
- An Integrated Mine Water Management Plan was compiled by J&W and JMA.

Although the findings from these specialist reports will be collated and summarized into this EIA and the corresponding EMP, the full specialist reports as submitted by the specialists, are attached as Appendices in a separate VOLUME IV to this EIAR.

The Public Participation Report is also attached as an Appendix in VOLUME IV.

2.5.2 Conduct EIA, Design EMP and Compile EIAR's

On approval of the Final Scoping Report and Plan of Study, JMA commenced with the base line studies and specialist studies. These studies were completed during August 2010 and provided the required information from which to compile the EIA and Draft EMP. The EIA was conducted in compliance with DEAT guidelines but also included the current SASOL MINING Impact Significance Ratings and Risk Quantification Protocol.

This report represents the EIAR for the EIA as prescribed in the EIA Regulations GNR 385 and contrains both the EIA and Draft EMP. The report contains listings of all the predicted impacts and their expected magnitude and significance for the different areas of the receiving environment.

The Draft Environmental Management Plan (EMP), containing measures to address and mitigate these identified environmental impacts, is included in this report.

2.5.3 EIA/EMP Public Meeting

A second public meeting during which the results of the specialist studies and impact assessment were discussed and explained to the I&AP's, was held on 4 November 2010.

2.5.4 Comments from I&AP's

After this second Public Meeting the I&AP's again had the opportunity to review and comment upon the all of the results of the EIA. All of the reports generated during the EIA were made available for public review. The Draft EIAR was made available for public review on Monday 15 November 2010. A 1 month public review period (as agreed by the meeting) - 15 November 2010 till 14 December 2010, was allowed.

2.5.5 Finalize and Submit EIA/EMP/EIARs

Once the review period expired, all of the comments raised by the I&APs were tabulated and addressed by the EAP, before submitting the final version of the various reports to the relevant authorities.

2.5.6 Authority Review & Decision

For the EIA documentation, submitted to DEDET and DMR on 14 January 2011, the authorities have a period of 60 days to review the reports with the option of sending them for specialist review which will take another 45 days, after which they will have 10 days to notify the applicant of their decision. It is hoped to have the Environmental Authorisation by the end of April 2011.

The IWWMP in support of the IWULA will also be submitted to DWA by end Jaunary 2011. DWA has indicated that, provided they are supplied with complete document/information sets, approval of the IWUL could possibly be done in a four month period, thus the end of May 2011.

A Waste License Application Report will also be submitted to DEDET by end January 2011. DEDET has indicated that , provided they are supplied with complete document/information sets, approval of the Waste License could possibly be done in a four month period, thus the end of May 2011.

The IWWMP in support of the IWULA will also be submitted to DWA by end Jaunary 2011. DWA has indicated that, provided they are supplied with complete document/information sets, approval of the IWUL could possibly be done in a four month period, thus the end of May 2011.

A Waste License Application Report will also be submitted to DEDET by end January 2011. DEDET has indicated that, provided they are supplied with complete document/information sets, approval of the Waste License could possibly be done in a four month period, thus the end of May 2011.

3. PUBLIC PARTICIPATION PROGRAM

A comprehensive Public Participation Program was conducted for the Middelbult Shondoni Project. The program was conducted by JMA Consulting in collaboration with BKS. A full Public Participation Report for this project is attached as APPENDIX 3(A) in VOLUME IV of this EIAR.

3.1 NEED FOR PUBLIC PARTICIPATION

Public participation is a fundamental part of the environmental authorisation process. Public participation is the only requirement for which exemption cannot be given unless no rights are affected by an application. This stems from the requirement that people have a right to be informed about potential decisions that may affect them and that they must be afforded an opportunity to influence those decision. Effective public participation also improves the ability of the competent authority to make informed decisions and result in improved decision-making as the views of all parties are considered.

The public participation process:

- provides an opportunity for Interested and Affected Parties (I&APs) to obtain clear, accurate and comprehensible information about the proposed activity, its alternatives or the decision and the environmental impacts thereof;
- provides I&APs with an opportunity to indicate their viewpoints, issues and concerns regarding the activity, alternatives and/or the decision;
- provides I&APs with the opportunity of suggesting ways of avoiding, reducing or mitigating negative impacts of an activity and for enhancing positive impacts;
- enables an applicant to incorporate the needs, preferences and values of affected parties into the activity;
- provides opportunities to avoid and resolve disputes and reconcile conflicting interests; and
- enhances transparency and accountability in decision-making.

Public participation therefore allows I&APs the opportunity to give their viewpoints, and influence the process and the decisions of the competent authority.

This is of particular importance during the scoping phase of an EIA as this stage constitutes the timeframe where most of the planning and design for the EIA/EMP phase of the EIA is done. Inputs from I&APs during this stage can therefore be addressed and incorporated in the planning of studies and investigations that are to follow.

Public Participation during the EIA phase will facilitate verification of the impact assessments in the EIA and will ensure that the proposed management objectives and management measures contained in the Draft EMP will be acceptable to the I&AP's. This will of course assist the authorities in their decision making in terms of approvals to be given.

3.2 PLANNING FOR PUBLIC PARTICIPATION

A comprehensive public participation program was designed for the Scoping Phase, as well as the EIA Phase, of the Sasol Mining, Middelbult Shondoni project. The program was derived from, and based on the conditions stipulated in regulations 56 to 59 of Government Notice R 385 (GNR 385), which contains the EIA Regulations in terms of Chapter 5 of NEMA. The *Guideline 4: Public Participation in support of the EIA Regulations; 2005,* produced by the, then, Department of Environmental Affairs and Tourism, was also used for guidance.

In the guideline document it is stated that the extent or scope of the public participation should be based on the extent of the envisaged impact, and not on the extent of the proposed development. Also, it states that minimum requirements set for one project will not necessarily be sufficient for another, and that each project should be considered on its own merit.

3.3 THE SCOPE OF THE PUBLIC PARTICIPATION PROGRAM

The guidelines referred to above were taken into consideration and it was decided that for the scoping phase of the EIA all of the identified I&APs would be notified according to regulations stipulated in GNR 385 informing them of the proposed project and inviting them to attend the public meeting that was scheduled for the 10th of November 2009 at the Evander Public Library. Along with these notifications were sent a comment sheet on which the I&APs could raise any concern they might have, or comment on a specific issue.

The scope of the Public Participation Programme conducted during the EIA phase of the project was along the same dimensions and considerations as the one that was conducted during the Scoping Phase of the EIA.

3.4 IDENTIFICATION/REGISTRATION OF AUTHORITIES AND IAP'S

During the pre-application phase of the EIA process members of JMA sat down and discussed the proposed project, investigating all of the proposed actions and determining what environmental authorisations will be required, and who the relevant lead authorities will be. During this discussion it was concluded that the Department of Mineral Resources (DMR), Department of Economic Development, Environment & Tourism (DEDET), and Department of Water Affairs (DWA) will be the lead authorities on this project.

During meetings held with the abovementioned authorities JMA inquired from them which other authorities do they also deem as important with regards to this project. The results of these queries amounted to the Regional Department's of Agriculture and Health, and the Mpumalanga Parks Board. Also representatives of Gert Sibande District Municipality and Govan Mbeki Local Municipality were identified. These authorities were notified of the project and invited to attend the Public Meeting that was held on 10 November 2009.

For the identification of the I&APs to the proposed project, members of JMA and BKS group consulted I&AP databases of previous projects obtained from Sasol Mining Rights and Property Department (SMRD).

BKS also used I&AP databases of previous projects done in the area. Furthermore anybody that responded to the newspaper advertisements, or notices were added to the I&AP database for this project. At the Public Meeting the I&APs were ask to provide details of persons that they deem necessary to be registered as an I&AP to the project. The current I&AP database for this project is attached as an APPENDIX to the Public Participation Report – VOLUME IV of this submission.

3.5 NOTIFICATION OF AUTHORITIES AND IAP'S

As prescribed in GNR 385, written notices were compiled containing information on the proposed project, details of the Applicant, the appointed Consultant, and the Scoping Phase Public Meeting that was held on 10 November 2009. Along with this notification letter, sent to the I&APs, was a BID (Background Information Document) that contained additional information regarding the Sasol Mining, Middelbult Shondoni project, and a comment sheet on which the I&AP could raise issues or concerns that he/she may have regarding the project. A copy of the BID and a copy of the notification letters are attached as APPENDICES to the Public Participation Report – VOLUME IV of this submission.

Press advertisements were also compiled and published in two regional newspapers, these being the Daily Sun (Mpumalanga Edition) and the Highveld Tribune. The advertisements also contained some information regarding the project along with details and invitation to the public meeting. The advertisements were placed during the two weeks preceding the public meeting. Please see proof of these adverts attached as an APPENDIX to the Public Participation Report – VOLUME IV of this submission.

Various site notices were put on site itself, and throughout the surrounding communities. These notices also contained information regarding the proposed project, its location, and an invitation to attend the Scoping Phase public meeting. Please see proof of these Notices attached as an APPENDIX to the Public Participation Report – VOLUME IV.

For the EIA Phase communication, the same methodology was applied. As prescribed in GNR 385, written notices were compiled containing information on the proposed project, details of the Applicant, the appointed Consultant, and the EIA Phase Public Meeting that was held on 2 September 2010. Along with this notification letter, sent to the I&APs, was a BID (Background Information Document) that contained updated information regarding the Sasol Mining, Middelbult Shondoni project, and a comment sheet on which the I&AP could raise issues or concerns that he/she may have regarding the project. A copy of the BID and a copy of the notification letters are attached as APPENDICES to the Public Participation Report – VOLUME IV of this submission.

Press advertisements were once again compiled and published in two regional newspapers, these being the Daily Sun (Mpumalanga Edition) and the Highveld Tribune. The advertisements also contained some information regarding the project along with details and invitation to the EIA public meeting. The advertisements were placed during the two weeks preceding the EIA public meeting. Please see proof of these adverts attached as an APPENDIX to the Public Participation Report – VOLUME IV of this submission.

Various site notices were once again put on site itself, and throughout the surrounding communities. These notices also contained information regarding the proposed project, its location, and an invitation to attend the EIA Phase public meeting. Please see proof of these Notices attached as an APPENDIX to the Public Participation Report – VOLUME IV of this submission.

3.6 INFORMATION TO AUTHORITIES AND IAP'S

The information that was sent to the Authorities and I&APs contained details of the following:

- First BID (Background to the Project);
- Description of actions to be undertaken for the current proposed project;
- Environmental authorisations that is required for the proposed project;
- Location of the project;
- Invitation to the Scoping Phase public meeting that was scheduled, and the role of the I&APs in the public participation process as a whole;
- Draft Scoping Report and Plan of Study, explaining the EIA process, giving details of the EAP, detailed project description, assessment of project alternatives, current status of the environment to be affected, listing of issues and concerns, a detailed plan of study and a Plan for Public Participation;
- Second BID (Additional Project Information) and Invitation to the EIA Phase public meeting that was scheduled;
- Draft EIA/EMP Report containing information as prescribed in the EIA and MPRDA regulations;
- Relevant application forms.

3.7 MEETINGS WITH AUTHORITIES AND IAP'S

Pre-consultation meetings were scheduled with the lead authorities, and the first of these was scheduled with representatives of the Department of Mineral Resources at their Regional Office in Witbank on 12 October 2009. The second pre-consultation meeting was scheduled for 21 October 2009 with representatives of the Department of Economic Development, Environment & Tourism at their offices in Ermelo. The third pre-consultation meeting was scheduled for 4 November 2009 with representatives of the Department of Water Affairs and the meeting took place at JMA's offices in Delmas. The minutes of the DMR, DEDET and DWA meetings are attached in APPENDICES to the Public Participation Report – VOLUME IV of this submission.

During these meetings the proposed project was presented and explained to these authorities and they were asked to provide inputs on their preference for further notification and consultation, format of documents to be submitted, and other authorities they deem relevant to the project. They were also consulted on the proposed timeline for the project and if they deem it realistic.

The identified I&APs were consulted during a Scoping Phase Public Meeting that was held on 10 November 2009 and a Focus Group Meeting for the Conveyor Route Selection that was held on 19 March 2010. Minutes of the scoping phase public meeting and information relevant to the focus group meeting is contained in a report attached as an APPENDIX to the Public Participation Report – VOLUME IV of this submission.

Two site visits were conducted with authorities. The first site visit was conducted with officials from Mpumalanga Parks Board on Friday 8 January 2010. The second site visit was conducted with officials from DEDET on Thursday 3 June 2010.

The identified I&APs were consulted again during an EIA Phase Public Meeting that was held on 3 November 2010. Minutes of the EIA Phase public meeting are attached as an APPENDIX to the Public Participation Report – VOLUME IV of this submission.

3.8 OBTAINING COMMENTS FROM AUTHORITIES AND IAP'S

Contained in all of the notifications sent out, and advertisements that was placed, were the full contact details of JMA and BKS along with an invitation to contact them regarding any issue or concerns that they may have regarding the project. A comment sheet was also attached to all notifications that were sent to the I&APs.

During the Scoping Phase Public Meeting it was conveyed to the I&APs, that the Draft Scoping Report will be made available as soon as JMA finished compiling it and Sasol Mining reviewed and approved the document. The Draft Scoping Report and Plan of Study was indeed made available for review at the following locations on 24 November 2009:

- Secunda Public Library
- Evander Public Library
- Kinross Public Library
- eMbalenhle Public Library

Furthermore the document was distributed to some of the I&AP's, that indicated that they will not be able to visit a library to review the document, in electronic format on a CD-ROM.

The I&AP's had up until 08 January 2010 to submit their comments, raise issues, propose investigations that needs to be conducted during the EIA/EMP phase of the EIA process. However, comments received as late as 18 March 2010 from MPB were considered and included. Comments received from the I&AP's are attached as an APPENDIX to the Public Participation Report – VOLUME IV of this submission.

Upon receipt of the comments, the Scoping Report and Plan of Study was finalized and was submitted to the relevant authorities (DEDET and DMR) for review and approval on 23 April 2010.

Both relevant authorities (DEDET and DMR) have reviewed the Scoping Report. DEDET issued a formal acceptance letter on 25 May 2010 and gave permission for the EIA process to continue – attached as an APPENDIX to the Public Participation Report – VOLUME IV of this submission.

DMR indicated that the process represents an EMPR Addendum in terms of the MPRDA, and therefore that DMR is not required to issue a formal acceptance of the Scoping Report. JMA was informed telephonically by DMR that the process can continue.

During the EIA Phase Public Meeting it was once more conveyed to the I&APs, that the Draft EIA and EMP will be made available for comments.

The Draft EIA and EMP was indeed made available for review at the following locations on 15 November 2010:

- Secunda Public Library
- Evander Public Library
- Kinross Public Library
- eMbalenhle Public Library

Furthermore the document was distributed to some of the I&AP's, that indicated that they will not be able to visit a library to review the document, in electronic format on a CD-ROM.

The I&AP's had up until 14 December 2010 to submit their comments. Comments received from the I&AP's are attached as an APPENDIX to the Public Participation Report – VOLUME IV of this submission.

Upon receipt of the comments, the EIA and EMP Reports were finalized and were submitted to the relevant authorities (DEDET and DMR) for review and approval on 14 January 2011.

The IWWMP which will be submitted to the DWA, as well as the Waste Application Report to be submitted to DEDET, are not usually presented for formal public review due to the complex and technical nature of the report, but should any I&AP wish to view these reports, it will be made available to them. Irrespective of this fact, the Water Use License Application as well as the Waste License Application for Middelbult Shondoni will be discussed with the I&AP's during the Public Meetings.

3.9 RESPONDING TO COMMENTS FROM AUTHORITIES AND IAP'S

JMA, after the Scoping Phase and EIA Phase review periods, collated all of the issues raised and comments that were submitted, into an I&AP Comments Register, and addressed each and every one of them before finalizing the Scoping Report, EIA Report and Draft EMP Report, prior to final submission to the relevant competent authorities.

3.10 PUBLIC PARTICIPATION PROGRAMME REPORT

A full description of the Public Participation Program, complete with the I&AP data base, all information sets made available, proof of all advertisements and notices, meeting agendas and minutes, as well as the formal project Comments Register was compiled and is submitted as an Appendix contained in VOLUME IV of this submission.

4. PROJECT/ACTIVITY DESCRIPTION

4.1 PROJECT TITLE

Project Title
Sasol Mining – Middelbult Shondoni : EMPR Addendum, EIA, IWULA and WLA

4.2 PROJECT ENVIRO-LEGAL FRAMEWORK

4.2.1 Listing of Relevant Acts, Regulations and Technical Guidance Considered

A review of the specific project components has indicated the following Environmental Acts, Regulations and Technical Guidance to be directly applicable for the Environmental Authorisations required for this project. An expanded, generic, Enviro-Legal Framework, as applicable to the overall EIA/EMPR/IWULA/WLA project is attached as APPENDIX 4.2(A).

Directly Applicable Environmental Legislation	
1.	National Environmental Management Act No. 107 of 1998 (NEMA)
2.	Mineral and Petroleum Resources Development Act No. 28 of 2002 (MPRDA)
3.	National Water Act No. 36 of 1998 (NWA)
4.	National Environmental Management: Waste Act No. 59 of 2008 (NEMWA)

The following regulations published in terms of these Acts, have pertinent bearing on inputs into this report:

Applicable Regulations	
NEMA	
1.	GNR 385 of 21 April 2006 – EIA Regulations
2.	GNR 386 of 21 April 2006 – Basic Assessment Listed Activities
3.	GNR 387 of 21 April 2006 – Scoping and EIA Listed Activities
MPRDA	
1.	GNR 527 of 23 April 2005 – Mineral and Petroleum Resources Development Regulations
NWA	
1.	GNR 3208 of 29 August 1969: Regional Standards for Industrial Effluents
2.	GN 991 of 18 May 1984: Requirements for the Purification of Waste Water or Effluent
3.	GNR 2834 of 27 December 1985: Regulations in terms of section 26, read in conjunction with section 12A of the Water Act, 1956 (Act 54 of 1956), for the erection, enlargement, operation and registration of water care works
4.	GNR 1560 of 25 July 1986: Regulations in terms of section 9C(6) of the Water Act, 1956, relating to dams with a safety risk
5.	GNR 704 of 4 June 1999 – Regulations on use of water for mining and related activities aimed at the protection of water resources
6.	GNR 1352 of 12 November 1999 – Regulations requiring that a water use be registered
7.	GNR 212 of 10 March 2000 – Request to register a water use
8.	GN 470 of 12 May 2000 – Request to register a water use
9.	GNR 398 of 26 March 2004 – General authorisations in terms of Section 39 of the National Water Act
10.	GNR 399 of 26 March 2004 – General authorisations in terms of Section 39 of the National Water Act
11.	GNR 519 of 6 May 2009 – Notice to Register a Water Use in terms of NWA

NEMWA
1. GNR 718 of 3 July 2009: List of Waste Management Activities that have, or are likely to have a Detrimental Effect on the Environment.

Applicable Technical Guidelines
DEDET
1. Integrated Environmental Management, Information Series 0, Overview of Integrated Environmental Management
2. Integrated Environmental Management, Information Series 1, Screening
3. Integrated Environmental Management, Information Series 2, Scoping
4. Integrated Environmental Management, Information Series 3, Stakeholder Engagement
5. Integrated Environmental Management, Information Series 4, Specialist Studies
6. Integrated Environmental Management, Information Series 5, Impact Significance
7. Integrated Environmental Management, Information Series 6, Ecological Risk Assessment
8. Integrated Environmental Management, Information Series 7, Environmental Resource Economics
9. Integrated Environmental Management, Information Series 8, Cost Benefit Analyses
10. Integrated Environmental Management, Information Series 9, Project Alternatives in EIA
11. Integrated Environmental Management, Information Series 10, Environmental Impact Reporting
12. Integrated Environmental Management, Information Series 11, Review in EIA
13. Integrated Environmental Management, Information Series 12, Environmental Management Plans
14. Integrated Environmental Management, Information Series 13, Environmental Auditing
15. Integrated Environmental Management, Information Series 14, Life Cycle Assessment
16. Integrated Environmental Management, Information Series 15, Strategic Environmental Assessment
17. Integrated Environmental Management, Information Series 16, Cumulative Effects Assessment
18. Integrated Environmental Management, Information Series 17, Environmental Reporting
19. Integrated Environmental Management, Information Series 18, Environmental Assessment of Trade Related Agreements and Policies in South Africa
20. Integrated Environmental Management, Information Series 19, Environmental Assessment of International Agreements
21. Integrated Environmental Management, Information Series 20, Linking EIA and EMS
22. Integrated Environmental Management, Information Series 21, Environmental Monitoring Committees
23. Integrated Environmental Management, Information Series 22, Socio-Economic Impact Assessment
24. Integrated Environmental Management, Information Series 23, Risk Management
25. Guideline 3: General Guide to the Environmental Impact Assessment Regulations
26. Guideline 4: Public Participation
27. Guideline 5: Assessment of Alternatives and Impacts
28. Guideline 6: Environmental Management Frameworks
29. Guideline 7: Detailed Guide to Implementation of the EIA Regulations
DMR
1. Aide Memoire for the Preparation of Environmental Management Programme Reports for Prospecting and Mining, DME, 1992
2. Guideline for Environmental Management Programme Compilation and Format, DME.
3. Social and Labour Plan Guidelines for the Mining and Production Industries
4. A Guideline for a Mining Work Programme to be submitted for Applications for a Mining Right in terms of the MPRDA
5. Series of Guidelines for the Determination of Financial Provision for the Mining Industry
DWA
1. External Guideline: Generic Water Use Authorisation Application Process, 2007
2. Internal Guideline: Generic Water Use Authorisation Application Process, 2007

3.	External Guideline: Section 21(c) and (i) Water Use Authorisation Application Process (impeding or diverting the flow of water in a watercourse and /or altering the bed, banks, course or characteristics of a watercourse)
4.	Internal Guideline: Section 21(c) and (i) Water Use Authorisation Application Process (impeding or diverting the flow of water in a watercourse and /or altering the bed, banks, course or characteristics of a watercourse)
5.	Internal Guideline: Section 21(e), (f), (g), (h) and (j) Water Use Authorisation Application Process (waste discharge related)
6.	Operational Guideline to Assist in the Compilation of an IWWMP, 2008
7.	Best Practice Guideline A2 – Water Management for Mine Residue Deposits; 2006
8.	Best Practice Guideline A4 – Pollution Control Dams; 2006
9.	Best Practice Guideline A6 – Water Management for Underground Mines; 2006
10.	Best Practice Guideline G1 – Storm Water Management; 2006
11.	Best Practice Guideline G2 – Water and Salt Balances; 2006
12.	Best Practice Guideline G3 – Water Monitoring Systems; 2006
13.	Best Practice Guideline G4 – Impact Prediction; 2006
14.	Best Practice Guideline H1 – Integrated Mine Water Management; 2006
15.	Best Practice Guideline H2 – Pollution Prevention and Minimization ; 2006
16.	Best Practice Guideline H3 – Water Reuse and Reclamation; 2006
17.	Best Practice Guideline H4 – Water Treatment; 2006

4.2.2 Existing Authorizations

All existing Environmental Authorisations for Middelbult Mine are listed below, whilst copies of the relevant ROD's, Permits and Licences are attached in APPENDIX 4.2(B).

Sequential Number	Existing Environmental Authorisations
1	Approved EMPR for Secunda Collieries (Middelbult Colliery) - 2002
2	Approved EMPR Addendum for Middelbult Block 8 - 2003
3	General Authorisations - pending
4	GN 704 Exemptions – pending
5	Registered Existing Water Uses – pending
6	Approval of Integrated Water Use License - pending

4.2.3 Environmental Authorizations Required for this Project

Based on the Enviro-Legal framework and having regard to the relevant and specific project attributes, a number of authorisations will be applied for during the course of the Environmental Authorisation Phase of this Project.

National Environmental Management Act, Act No. 107 of 1998		
Section 24	**Environmental Authorisation Application**	
GNR 386		
Activity 1(c)	The construction of facilities or infrastructure, including associated structures of infrastructure, for – the storage of 250 tons or more but less than 100 000 tons of coal	Coal throw out stockpile area at Shondoni Shaft
Activity 1(m)	The construction of facilities or infrastructure, including associated structures of infrastructure, for – any purpose in the 1:10 year flood line of a river or stream, or within 32 *m* from the bank of the river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including – (i) canals; (ii) channels; (iii) bridges; (iv) dams; (v) weirs	Conveyor Pedestal for crossing of Trichardt Spruit
Activity 1(n)	The construction of facilities or infrastructure, including associated structures of infrastructure, for – the off-stream storage of water, including dams and reservoirs, with a capacity of 50 000 cubic metres or more, unless such storage falls within the ambit of the activity listed in item 6 of Government Notice No. R. 387 of 2006	Service Water Dams and Storm Water Pollution Control Dam at Shondoni Shaft Complex
Activity 4	The dredging, excavation, infilling, removal or moving of soil, sand or rock exceeding 5 cubic metres from a river, tidal lagoon, tidal river, lake, in-stream dam, floodplain or wetland.	Excavation for Coal Conveyor Pedestal for crossing of Trichardt Spruit
Activity 7	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic metres but less than 1 000 cubic metres at any one location or site.	Diesel Fuel Storage Tanks at Shondoni Shaft Complex
Activity 12	The transformation or removal of indigenous vegetation of 3 hectares or more or of any size where the transformation or removal would occur within a critically endangered or an endangered ecosystem listed in terms of it section 52 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	Removal of Indigenous Vegetation during Site Clearance for Construction of Shondoni Shaft Complex and related Infrastructure
Activity 13	The abstraction of groundwater at a volume where any general authorisation issued in terms of the National Water Act, 1998 (Act No. 36 of 1998) will be exceeded.	Removal of water found in the underground workings on the No.4 Seam and the No.2 Seam workings to facilitate the efficient continuation of mining and for the safety of people
Activity 14	The construction of masts of any material or type and of any height, including those used for telecommunication broadcasting and radio transmission.	Tetra Radio System that will be installed above ground at the Shaft Complex Area.
Activity 15	The construction of a road that is wider than 4 metres or that has a reserve wider than 6 metres, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 metres long.	Access Road to Shondoni Shaft Complex from Tar road R547
GNR 387		
Activity 1 (l)	The construction of facilities or infrastructure, including associated structures or infrastructure, for – the transmission and distribution of above ground electricity with a capacity of 120 kilovolts or more.	Double Circuit 132 kV Overhead Poweline from Eskom Supply Point (SOL B) to Shondoni Mine Transmission Feeder Bays.

Activity 1(j)	The construction of facilities or infrastructure, including associated structures or infrastructure, for – the bulk transportation of dangerous goods using pipelines, funiculars or conveyors with a throughput capacity of 50 tons or 50 cubic metres or more per day.	Coal Conveyor from Shondoni Shaft to Middelbult Main Shaft (Sasol Coal Supply, the central coal stockpile area).
Activity 2	Any development activity, including associated structures and infrastructure, where the total area of the developed area is, or is intended to be, 20 hectares or more.	Developed area including shaft surface infrastructure and conveyor route.

Mineral and Petroleum Resources Development Act, Act No. 28 of 2002		
MPRDA Section 44	**Mining Right Application**	

National Water Act, Act No. 36 of 1998		
NWA Section 40	**Integrated Water Use License Application (Includes Registrations)**	
Section 21(a)	Taking water from a water resource	Service water used underground sourced from underground water make (21(j))
Section 21(c)	Impeding or diverting the flow of water in a watercourse	Coal conveyor from Shondoni Shaft to Central Coal Stockpile Area
Section 21(f)	Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit	Shondoni Shaft Sewerage Plant
Section 21(g)	Disposing of waste in a manner which may detrimentally impact on a water resource	Shondoni Shaft Service Water Dams, Storm Water PCD and Shondoni Shaft Berms Walls
Section 21(i)	Altering the bed, banks, course or characteristics of a watercourse	Coal Conveyor from Shondoni Shaft to Central Coal Stockpile Area. Possible stream diversion at Shaft Locality for Incline Shaft.
Section 21(j)	Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people	Removing Mine Water Make from the No.4 Seam and No.2 Seam Underground Works
NWA Section 39	**General Authorisations**	
Section 21(c)	To be applied for in consultation with DWAF	
Section 21(f)	To be applied for in consultation with DWAF	
Section 21(g)	To be applied for in consultation with DWAF	
Section 21(i)	To be applied for in consultation with DWAF	
GNR 1352	**Water Use Registration**	
	Included in Water Use License Application and/or General Authorisation	
GNR 740 (R 3)	**Exemptions from GNR 704**	
Regulation 4 (a) (Restrictions On Locality)	No person in control of a mine or activity may 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 water course or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on water-logged ground, or on ground likely to become water-logged, undermined, unstable or cracked.	Shondoni Shaft Complex
Regulation 4 (b) (Restrictions On Locality)	No person in control of a mine or activity may, except in relation to a matter contemplated in Regulation 10 (winning sand and alluvial minerals), carry on any underground or opencast mining, prospecting or any other operation or activity under or within the 1:50 year flood line or within a horizontal distance of 100 metres from any water course or estuary, whichever is the greatest.	Entire Middelbult, Block 8, Springbokdraai and Leeuwpan Reserve
Regulation 4 (d) (Restrictions On Locality)	No person in control of a mine or activity may 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 water course or estuary.	Shondoni Shaft Complex and Coal Conveyor from Shondoni Shaft to Middelbult Main Shaft (Sasol Coal Supply, the central coal stockpile area).

Regulation 5 (Restrictions On Use of Material)	No person in control of a mine or activity may use any residue or substance which causes or is likely to cause pollution of a water resource for the construction of any dam or other impoundment or any embankment, road or railway, or for any other purpose which is likely to cause pollution of a water resource.	Use of overburden material excavated from Shondoni Shafts for construction of berms around Shondoni Shaft Complex

National Environmental Management Waste Act, Act No. 59 of 2009		
NEMWA Section 45	**Application for Waste Management Licences**	
Category B (7)	Treatment of sewage with an annual throughput capacity of 15 000 cubic metres or more.	Shondoni Shaft Sewerage Plant.

4.3 PROJECT PROPONENT/APPLICANT

Project Applicant:	Sasol Mining (Pty) Ltd
	Private Bag X 1015
	Secunda
	2302
Mineral Rights Holder:	Sasol Mining (Pty) Ltd
	Private Bag X 1015
	Secunda
	2302
Mining Authorisation Holder:	Sasol Mining (Pty) Ltd
	Private Bag X 1015
	Secunda
	2302
Mine:	Middelbult (Block 8) Shondoni Project
	Private Bag X 1015
	Secunda
	2302
Mine Manager:	Mr Gerrit van der Westhuyzen
Contact Person:	Dr Gail Nussey
Telephone no:	+ 27 17 614 2207
Fax no:	+ 27 11 522 9272
E-mail:	gail.nussey@sasol.com

4.4 PROJECT LOCATION/RELEVANT GOVERNING AUTHORITIES

4.4.1 Regional Setting

Middelbult Colliery, including the Shondoni Shaft, in the Block 8 Reserves of Middelbult Colliery, is located in the Mpumalanga Province of South Africa. The site locality, in relation to neighbouring towns/cities, is given in Table 4.4.1(a) below.

Table 4.4.1(a): Locality of Middelbult Colliery in relation to nearest Towns/Cities

Town	Distance from Site (km)	Direction from Site
eMbalenhle	7	South
Kinross	7	North
Evander	5	East
Secunda	15	East
Trichardt	19	East

The regional setting of the project site is delineated on the map shown in Figure 4.4.1(a) below.

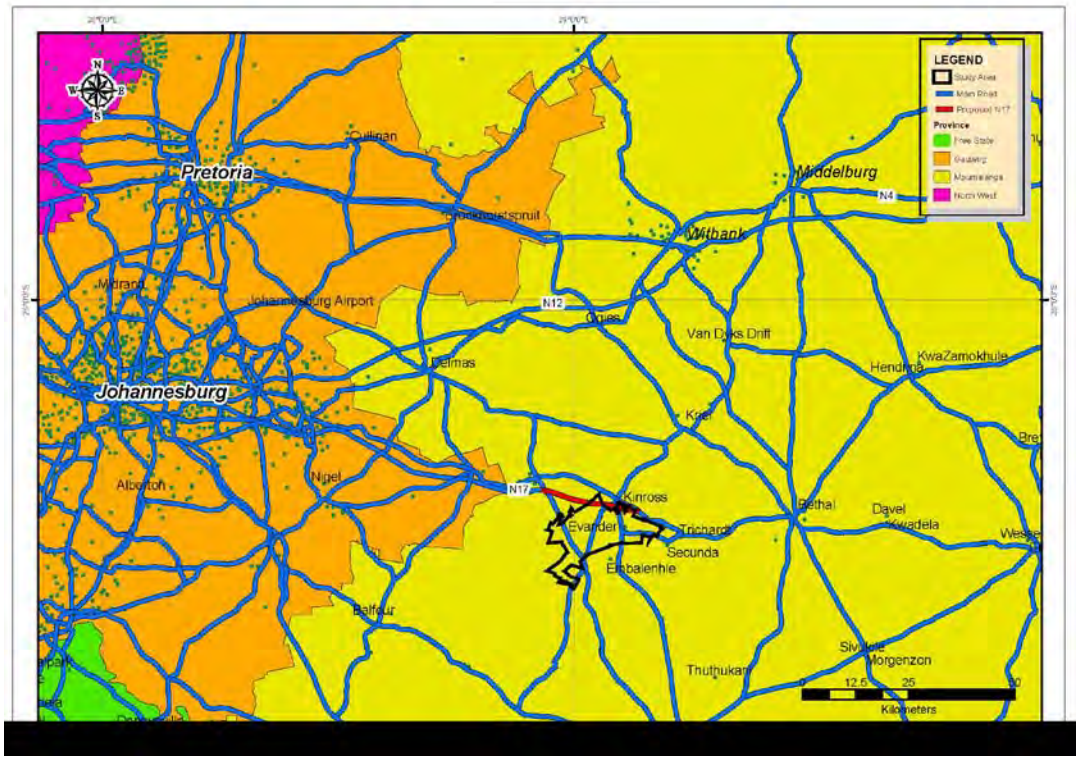


Figure 4.4.1(a): Regional Setting of the Project

4.4.2 Relevant Authorities

4.4.2.1 National Authorities

Department of Water and Environmental Affairs (DWEA)

National Department:	Department of Water Affairs (Head Office)
Directorate/Designation:	PWPCO
Contact Person:	Nemalili Khathutshelo
Postal Address:	Private Bag X 313, Pretoria, 0001
Telephone no:	+ 27 12 336 8659
Fax no:	+ 27 12 323 0321
Cellular Phone:	+ 27 79 871 3657
E-mail:	nemalilik@dwaf.gov.za

4.4.2.2 Provincial/Regional Authorities

Department of Water Affairs (DWA)

Regional Department:	Gauteng Region
Directorate/Designation:	SWPCO
Contact Person:	Joyce Lekoane
Postal Address:	Private bag X 995, Pretoria, 0001
Telephone no:	+ 27 12 392 1381
Fax no:	+ 27 12 392 1359
Cellular Phone:	+ 27 82 600 5669
E-mail:	lekoanej@dwaf.gov.za
Water Management Area	Waterval Catchment

Department of Mineral Resources (DMR)

Regional Department:	Mpumalanga Region
Directorate/Designation:	Witbank Office
Contact Person:	Bethuel Matodzi
Postal Address:	Private Bag X 7279, Witbank, 1035
Telephone no:	+ 27 13 656 1448
Fax no:	+ 27 13 690 3288
Cellular Phone:	+ 27 82 621 3559
E-mail:	bethuel.matodzi@dme.gov.za

Department of Economic Development, Environment and Tourism

Regional Department:	Mpumalanga
Directorate/Designation:	Ermelo
Contact Person:	Surgeon Marebane
Postal Address:	P O Box 2777, Ermelo, 2350
Telephone no:	+ 27 17 819 1155
Fax no:	0 86 516 3658
Cellular Phone:	+ 27 72 408 3138
E-mail:	surgeon@environ1.agric.za

Department of Agriculture, Rural Development and Land Administration

Regional Department:	Mpumalanga
Directorate/Designation:	Nelspruit
Contact Person:	Love Shabane
Postal Address:	P O Box 8866, Nelspruit, 1200
Telephone no:	+ 27 13 755 1420
Fax no:	+ 27 13 755 1961
Cellular Phone:	+ 27 82 428 4480
E-mail:	loves@nda.agric.za

Mpumalanga Tourism & Parks Agency (MTPA)

Office:	Ermelo
Directorate/Designation:	Environmental Authorisations
Contact Person:	Vaino Prinsloo
Postal Address:	P O Box 1250, Groblersdal, 0470
Telephone no:	+ 27 17 819 5346
Fax no:	0 86 609 0238
Cellular Phone:	+ 27 82 468 5447
E-mail:	vaino@vodamail.co.za

4.4.2.3 District/Local Authorities

District Municipality

District Authority:	Gert Sibande District Municipality
Designation:	Health & Social
Contact Person:	Mr D Hlanyane
Postal Address:	P O Box 550, Secunda, 2302
Telephone no:	+ 27 17 620 3000
Fax no:	+ 27 17 631 1607
Cellular Phone:	+ 27 82 904 0736
E-mail:	dan.hlanyane@gsibande.gov.za

Local Municipality

Local Authority:	Govan Mbeki Local Municipality
Designation:	HOD: Public Safety
Contact Person:	Mrs A Aphane
Postal Address:	Private Bag X 1017, Secunda, 2302
Telephone no:	+ 27 17 620 6000
Fax no:	+ 27 17 634 8019
E-mail:	kgomotso.a@govanmbeki.gov.za

4.5 PROPERTY DESCRIPTION/LAND OWNER/ZONING/SERVITUDES

AFFECTED PROPERTIES SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT					
No.	**Property Name**	**Portion**	**Owner**	**Zoning Status**	**21 Digit Surveyor General ID Number**
BLOCK 8 NORTHERN RESERVE					
1	Winkelhaak 135 IS	5 8 12 14	Homann A L	Urban Influence	**T0IS00000000013500005** **T0IS00000000013500008** **T0IS00000000013500012** **T0IS00000000013500014**
2	Winkelhaak 135 IS	11	Jacanelpe Trust	Urban Influence; Industrial; Open Space; Low Impact Mixed Use	**T0IS00000000013500011**
3	Winkelhaak 135 IS	24	Lombard M P	Urban Influence; Industrial	**T0IS00000000013500024**
4	Winkelhaak 135 IS	26	Republic of South Africa	Industrial	**T0IS00000000013500026**
5	Winkelhaak 135 IS	47	M & P Prop Trust	Industrial	**T0IS00000000013500047**
6	Winkelhaak 135 IS	66 67 122 123 125 126 127 129	Transnet Ltd	Urban Influence; Industrial	**T0IS00000000013500066** **T0IS00000000013500067** **T0IS00000000013500122** **T0IS00000000013500123** **T0IS00000000013500125** **T0IS00000000013500126** **T0IS00000000013500127** **T0IS00000000013500129**
7	Winkelhaak 135 IS	120	Afgri Operations Ltd	Low Impact Industrial	**T0IS00000000013500120**
8	Winkelhaak 135 IS	138	Pride Milling Co Pty Ltd	Low Impact Industrial	**T0IS00000000013500138**
9	Kinross 133 IS	6	Vosstoffel Pty Ltd	Urban Influence	**T0IS00000000013300006**
10	Zondagsfontein 124 IS	12 26	Vosstoffel Pty Ltd	Agriculture	**T0IS00000000012400012** **T0IS00000000012400026**
11	Zondagsfontein 124 IS	10	Kinross Farms (Pty) Ltd	Urban Influence	**T0IS00000000012400010**
12	Zondagsfontein 124 IS	29	Municipality Kinross	Urban Influence	**T0IS00000000012400029**
13	Uitkyk 136 IS	Rem Ext	A G van der Bergh	Urban Influence	**T0IS00000000013600000**

AFFECTED PROPERTIES SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT					
No.	**Property Name**	**Portion**	**Owner**	**Zoning Status**	**21 Digit Surveyor General ID Number**
BLOCK 8 RESERVE					
14	Klipfontein 357 IR	4	MH De La Rey Trust	Agriculture	**T0IR00000000035700004**
15	Klipfontein 357 IR	5 7	Jaco De La Rey Trust	Agriculture	**T0IR00000000035700005** **T0IR00000000035700007**
16	Brakspruit 359 IR	1	JH Van Der Merwe	Agriculture	**T0IR00000000035900001**
17	Brakspruit 359 IR	2	EL Du Preez	Agriculture	**T0IR00000000035900002**
18	Brakspruit 359 IR	3 15	Wim Karen Trust	Agriculture	**T0IR00000000035900003** **T0IR00000000035900015**
19	Brakspruit 359 IR	4	Gegana Business Enterprises CC	Agriculture	**T0IR00000000035900004**
20	Brakspruit 359 IR	5	Jaco De La Rey Trust	Agriculture	**T0IR00000000035900005**
21	Brakspruit 359 IR	7 11	FJ Van Aswegen	Agriculture	**T0IR00000000035900007** **T0IR00000000035900011**
22	Brakspruit 359 IR	8	CJ Minnie	Agriculture	**T0IR00000000035900008**
23	Brakspruit 359 IR	12	TA Van Niekerk	Agriculture	**T0IR00000000035900012**
24	Brakspruit 359 IR	13	ZJ Kloppers	Agriculture	**T0IR00000000035900013**
25	Brakspruit 359 IR	16 19	Republic of South Africa	Agriculture	**T0IR00000000035900016** **T0IR00000000035900019**
26	Brakspruit 359 IR	18 Rem Ext	HMR Becker	Agriculture	**T0IR00000000035900018** **T0IR00000000035900000**
27	Rietkuil 531 IR	6	Salt Holdings Ltd	Agriculture	**T0IR00000000053100006**
28	Rietkuil 531 IR	7	Republic of South Africa	Agriculture	**T0IR00000000053100007**
29	Rietkuil 531 IR	8	Evander Gold Mines Ltd	Agriculture	**T0IR00000000053100008**
30	Rietkuil 531 IR	Rem Ext	PF Louwrens Trust	Agriculture	**T0IR00000000053100000**
31	Springbokdraai 277 IS	1	RT Du Preez	Agriculture	**T0IS00000000027700001**
32	Springbokdraai 277 IS	6	DD Swanepoel	Agriculture	**T0IS00000000027700006**
33	Springbokdraai 277 IS	8	Springbokdraai Boerdery (Pty) Ltd	Agriculture	**T0IS00000000027700008**

AFFECTED PROPERTIES SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT					
No.	**Property Name**	**Portion**	**Owner**	**Zoning Status**	**21 Digit Surveyor General ID Number**
34	Leeuwpan 532 IR	1 8 12 13	HB Louwrens Trust	Agriculture	**T0IR00000000053200001** **T0IR00000000053200008** **T0IR00000000053200012** **T0IR00000000053200013**
35	Leeuwpan 532 IR	2 6 9 11 14 15	Salt Holdings Ltd	Agriculture	**T0IR00000000053200002** **T0IR00000000053200006** **T0IR00000000053200009** **T0IR00000000053200011** **T0IR00000000053200014** **T0IR00000000053200015**
36	Roodebank 323 IS	16	DA Urquhart	Agriculture	**T0IS00000000032300016**
37	Kromdraai 128 IS	1 3 4 10	HA Nell	Agriculture	**T0IS00000000012800001** **T0IS00000000012800003** **T0IS00000000012800004** **T0IS00000000012800010**
38	Kromdraai 128 IS	2 13	C Nell	Agriculture	**T0IS00000000012800002** **T0IS00000000012800013**
39	Kromdraai 128 IS	8 14 15 Rem Ext	Braam De La Rey Trust	Agriculture	**T0IS00000000012800008** **T0IS00000000012800014** **T0IS00000000012800015** **T0IS00000000012800000**
40	Kromdraai 128 IS	9 12	PR Nell	Agriculture	**T0IS00000000012800009** **T0IS00000000012800012**
41	Kromdraai 128 IS	17	MRH Combrink	Agriculture	**T0IS00000000012800017**
42	Kromdraai 128 IS	18	JC Roarty	Agriculture	**T0IS00000000012800018**
43	Ruigtekuilen 129 IS	1	CE Combrink	Agriculture	**T0IS00000000012900001**
44	Ruigtekuilen 129 IS	Rem Ext	MRH Combrink	Agriculture	**T0IS00000000012900000**
45	Leeuwspruit 134 IS	Rem Ext	Evander Gold Mines Ltd	Agriculture; Urban Influence	**T0IS00000000013400000**

AFFECTED PROPERTIES SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT					
No.	**Property Name**	**Portion**	**Owner**	**Zoning Status**	**21 Digit Surveyor General ID Number**
46	Witkleifontein 131 IS	1	Sakhisiswe CPA	Agriculture; Urban Influence	**T0IS00000000013100001**
47	Witkleifontein 131 IS	2 3 4 Rem Ext	Evander Gold Mines Ltd	Agriculture; Urban Influence; Industrial; Open Space	**T0IS00000000013100002** **T0IS00000000013100003** **T0IS00000000013100004** **T0IS00000000013100000**
48	Zandfontein 130 IS	2 5 12	Brendan Village	Agriculture	**T0IS00000000013000002** **T0IS00000000013000005** **T0IS00000000013000012**
49	Zandfontein 130 IS	3 8 9	Evander Gold Mines Ltd	Agriculture	**T0IS00000000013000003** **T0IS00000000013000008** **T0IS00000000013000009**
50	Zandfontein 130 IS	4	EL Du Plooy	Agriculture	**T0IS00000000013000004**
51	Zandfontein 130 IS	6	Zandfontein MMC Eiendomme CC	Agriculture	**T0IS00000000013000006**
52	Zandfontein 130 IS	11	Telkom SA Ltd	Agriculture	**T0IS00000000013000011**
53	Zandfontein 130 IS	19	AP De Andrade	Agriculture	**T0IS00000000013000019**
54	Zandfontein 130 IS	21	AM Rootman	Agriculture	**T0IS00000000013000021**
55	Zandfontein 130 IS	25	Frenken Brothers Prop CC	Agriculture	**T0IS00000000013000025**
56	Grootspruit 279 IS	Rem Ext	Evander Gold Mines Ltd	Urban Influence	**T0IS00000000027900000**
57	Addullam 577 IS	Rem Ext	Adullam Trust	Medium Density Residential; Low Impact Industrial; Institutional; Utility; Open Space	**T0IS00000000057700000**
58	Langverwacht 282 IS	2	Evander Gold Mines Ltd	Open Space	**T0IS00000000028200002**
59	Langverwacht 282 IS	6 7	Govan Mbeki Local Municipality	Open Space; Medium Density Residential	**T0IS00000000028200006** **T0IS00000000028200007**
60	Langverwacht 282 IS	13	Murray & Roberts Ltd	Low Impact Industrial	**T0IS00000000028200013**
61	Langverwacht 282 IS	16	Unitrans Freight Pty Ltd	Low Impact Industrial	**T0IS00000000028200016**

AFFECTED PROPERTIES SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT					
No.	**Property Name**	**Portion**	**Owner**	**Zoning Status**	**21 Digit Surveyor General ID Number**
62	Goedverwachting 287 IS	Rem Ext	Evander Gold Mines Ltd	Medium Density Residential; Urban Influence; Open Space; Industrial; Future Roads; Quarrying & Mining	**T0IS00000000028700000**
63	Winkelhaak 135 IS	1 7	Barelena Boerdery CC	Urban Influence	**T0IS00000000013500001** **T0IS00000000013500007**
64	Winkelhaak 135 IS	3	ML Wienand	Medium Density Residential; Open Space; Quarrying & Mining	**T0IS00000000013500003**
65	Winkelhaak 135 IS	4	8 Mile Inv 126 Pty Ltd	Urban Influence; Low Impact Industrial; Open Space; Low Impact Mixed Use	**T0IS00000000013500004**
66	Winkelhaak 135 IS	9	Vosstoffel Pty Ltd	Urban Influence	**T0IS00000000013500009**
67	Winkelhaak 135 IS	10 15 16	CE Combrink	Urban Influence	**T0IS00000000013500010** **T0IS00000000013500015** **T0IS00000000013500016**
68	Winkelhaak 135 IS	13 37 55 56 84 86 93	Evander Gold Mines Ltd	Medium Density Residential; Open Space; Quarrying & Mining	**T0IS00000000013500013** **T0IS00000000013500037** **T0IS00000000013500055** **T0IS00000000013500056** **T0IS00000000013500084** **T0IS00000000013500086** **T0IS00000000013500093**
69	Winkelhaak 135 IS	20	JC Lombard	Urban Influence	**T0IS00000000013500020**
70	Winkelhaak 135 IS	24	MP Lombard	Urban Influence; Low Impact Industrial	**T0IS00000000013500024**
71	Winkelhaak 135 IS	32 49 50	Red Coral Inv 125 Pty Ltd	Urban Influence; Medium Density Residential; Open Space; Suburban Mixed Use; Institutional; Medium-High Density Residential; Low Impact Industrial; Low Impact Mixed Use	**T0IS00000000013500032** **T0IS00000000013500049** **T0IS00000000013500050**

AFFECTED PROPERTIES SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT					
No.	**Property Name**	**Portion**	**Owner**	**Zoning Status**	**21 Digit Surveyor General ID Number**
72	Winkelhaak 135 IS	65 67 124	Transnet Ltd	Industrial; Open Space; Urban Influence	**T0IS00000000013500065** **T0IS00000000013500067** **T0IS00000000013500124**
73	Winkelhaak 135 IS	69 70 81	Republic of South Africa	High Impact Industrial	**T0IS00000000013500069** **T0IS00000000013500070** **T0IS00000000013500081**
74	Winkelhaak 135 IS	82 92	Lindeque Trust	Urban Influence	**T0IS00000000013500082** **T0IS00000000013500092**
75	Winkelhaak 135 IS	83	Raad op Plaaslike Bestuursaangeleenthede	Urban Influence	**T0IS00000000013500083**
76	Winkelhaak 135 IS	94	AP De Andrade	Urban Influence	**T0IS00000000013500094**
77	Winkelhaak 135 IS	101 104 107	Municipality Evander	Utilities; Open Space	**T0IS00000000013500101** **T0IS00000000013500104** **T0IS00000000013500107**
78	Winkelhaak 135 IS	133	Govan Mbeki Local Municipality	Medium-High Density Residential	**T0IS00000000013500133**
79	Winkelhaak 135 IS	134 135	Andrew James Trust	Low-Medium Density Residential; Medium-High Density Residential; Open Space; Utilities; Future Roads	**T0IS00000000013500134** **T0IS00000000013500135**
80	Kinross 133 IS	6	Vosstoffel Pty Ltd	Urban Influence	**T0IS00000000013300006**
81	Driefontein 137 IS	3 15 16 19 20	Moonstone Inv 11 Pty Ltd	Urban Influence; Medium Density Residential	**T0IS00000000013700003** **T0IS00000000013700015** **T0IS00000000013700016** **T0IS00000000013700019** **T0IS00000000013700020**
82	Driefontein 137 IS	4	Harvest Ministries	Open Space; Urban Influence	**T0IS00000000013700004**

AFFECTED PROPERTIES SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT					
No.	**Property Name**	**Portion**	**Owner**	**Zoning Status**	**21 Digit Surveyor General ID Number**
83	Driefontein 137 IS	6 22	Evander Gold Mines Ltd	Low-Medium Density Residential; Medium Density Residential; Medium-High Density Residential; Open Space; Quarrying & Mining; Low Impact Industrial; High Impact Industrial; Future Roads; General Mixed Use; Subsidised Housing	**T0IS00000000013700006** **T0IS00000000013700022**
84	Driefontein 137 IS	7	Extra Dimensions 1006 CC	Medium Density Residential; Open Space; Urban Influence	**T0IS00000000013400000**
85	Driefontein 137 IS	13 18	DC Hulley	Urban Influence	**T0IS00000000013700013** **T0IS00000000013700018**
86	Driefontein 137 IS	24 57	Eskom Holdings Ltd	Urban Influence	**T0IS00000000013700024** **T0IS00000000013700057**
87	Driefontein 137 IS	66	Highveld Ridge Transitional Local Council	Medium Density Residential; Open Space	**T0IS00000000013700066**
88	Uitkyk 136 IS	3	Eskom Holdings Ltd	Urban Influence	**T0IS00000000013600003**
89	Uitkyk 136 IS	4	Transnet Ltd	Urban Influence	**T0IS00000000013600004**
90	Holfontein 138 IS	2 3	CJ Terblanche Pty Ltd	Urban Influence	**T0IS00000000013800002** **T0IS00000000013800003**
MIDDELBULT RESERVE					
91	Springbokdraai 277 IS	3 4 Rem Ext	Springbokdraai Boerdery (Pty) Ltd	Agriculture	**T0IS00000000027700003** **T0IS00000000027700004** **T0IS00000000027700000**
92	De Bank 280 IS	10	Springbokdraai Boerdery (Pty) Ltd	Agriculture	**T0IS00000000028000010**
93	De Bank 280 IS	11 Rem Ext	HJP Louwrens Beleggings CC	Agriculture	**T0IS00000000028000011** **T0IS00000000028000000**
94	Grootspruit 279 IS	1 8 11 20	Republic of South Africa	Open Space; Municipal Commonage; Medium Density Residential; High Impact Industrial; Suburban Mixed Use	**T0IS00000000027900001** **T0IS00000000027900008** **T0IS00000000027900011** **T0IS00000000027900020**

AFFECTED PROPERTIES SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT					
No.	**Property Name**	**Portion**	**Owner**	**Zoning Status**	**21 Digit Surveyor General ID Number**
95	Grootspruit 279 IS	2 9 10	Govan Mbeki Local Municipality	Agriculture; Urban Influence; Open Space; Agriculture	**T0IS00000000027900002** **T0IS00000000027900009** **T0IS00000000027900010**
96	Grootspruit 279 IS	3 5 Rem Ext	Evander Gold Mines Ltd	Agriculture; Urban Influence	**T0IS00000000027900003** **T0IS00000000027900005** **T0IS00000000027900000**
97	Grootspruit 279 IS	4	ML Wienand	Agriculture	**T0IS00000000027900004**
98	Grootspruit 279 IS	6	MJ Dakile	Agriculture	**T0IS00000000027900006**
99	Grootspruit 279 IS	7	JC Els	Agriculture; Open Space	**T0IS00000000027900007**
100	Grootspruit 279 IS	12 13 14	Siyalinga Small Scale Farmers Co-Operative	Agriculture	**T0IS00000000027900012** **T0IS00000000027900013** **T0IS00000000027900014**
101	Grootspruit 279 IS	17	Sasol Mining Pty Ltd	Agriculture	**T0IS00000000027900017**
102	Rietkuil 283 IS	3	Sasol Mining Pty Ltd	Agriculture	**T0IS00000000028300003**
103	Rietkuil 283 IS	4	ML Wienand	Agriculture	**T0IS00000000028300004**
104	Rietkuil 283 IS	5 6 7	Republic of South Africa	Urban Influence; Institutional; Agriculture	**T0IS00000000028300005** **T0IS00000000028300006** **T0IS00000000028300007**
105	Rietkuil 283 IS	8	Embalenhle Community Trust	Agriculture	**T0IS00000000028300008**
106	Rietkuil 283 IS	9	SA Ndlela	Agriculture	**T0IS00000000028300009**
107	Branddrift 322 IS	1	EM Plant	Agriculture	**T0IS00000000032200001**
108	Branddrift 322 IS	11	J&M Viljoen	Agriculture	**T0IS00000000032200011**
109	Langverwacht 282 IS	2	Evander Gold Mines Ltd	Open Space	**T0IS00000000028200002**
110	Langverwacht 282 IS	1 4	Nanini 357 CC	Open Space; Low Impact Industrial; Urban Influence; Institutional	**T0IS00000000028200004**

AFFECTED PROPERTIES SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT					
No.	**Property Name**	**Portion**	**Owner**	**Zoning Status**	**21 Digit Surveyor General ID Number**
111	Langverwacht 282 IS	6 7 20	Govan Mbeki Local Municipality	Open Space;Medium Density Residential; Institutional; Medium High Density Residential; General Mixed Use; Open Space; Suburban Mixed Use; Low Impact Industrial; Utilities; Low Impact Mixed Use	**T0IS00000000028200006** **T0IS00000000028200007** **T0IS00000000028200020**
112	Langverwacht 282 IS	8 9 17 18	Municipality eMbalenhle	Open Space; Medium Density Residential; Institutional; Medium High Density Residential; General Mixed Use; Open Space; Suburban Mixed Use; Low Impact Industrial; Utilities; Low Impact Mixed Use	**T0IS00000000028200008** **T0IS00000000028200009** **T0IS00000000028200017** **T0IS00000000028200018**
113	Langverwacht 282 IS	10 11	Highveld Ridge Transitional Local Council	Open Space;Medium Density Residential; Institutional; Medium-High Density Residential; Open Space; Suburban Mixed Use; Low Impact Mixed Use	**T0IS00000000028200010** **T0IS00000000028200011**
114	Langverwacht 282 IS	13	Murray & Roberts Ltd	Low Impact Industrial	**T0IS00000000028200013**
115	Langverwacht 282 IS	16	Unitrans Freight Pty Ltd	Low Impact Industrial	**T0IS00000000028200016**
116	Langverwacht 282 IS	19	Sasol Synfuels Pty Ltd	Urban Influence	**T0IS00000000028200019**
117	Langverwacht 282 IS	46 48	Sasol Prop Pty Ltd	Open Space; Institutional; Medium Density Residential; Medium-High Density Residential; Low Impact Industrial	**T0IS00000000028200046** **T0IS00000000028200048**
118	Langverwacht 282 IS	51 52 59	Sasol Property Specialists 1 Pty Ltd	Low Impact Industrial	**T0IS00000000028200051** **T0IS00000000028200052** **T0IS00000000028200059**

AFFECTED PROPERTIES SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT					
No.	**Property Name**	**Portion**	**Owner**	**Zoning Status**	**21 Digit Surveyor General ID Number**
119	Goedverwachting 287 IS	Rem Ext	Evander Gold Mines Ltd	Medium Density Residential; Urban Influence; Open Space; Industrial; Future Roads Quarrying & Mining	**T0IS00000000028700000**
120	Winkelhaak 135 IS	3	ML Wienand	Medium Density Residential;Open Space;Quarrying & Mining	**T0IS00000000013500003**
121	Winkelhaak 135 IS	13	Evander Gold Mines Ltd	Medium Density Residential; Open Space; Quarrying & Mining	**T0IS00000000013500013**
122	Halvepan 286 IS	Rem Ext	Sasol Synfuels Pty Ltd	Industrial Urban Influence	**T0IS00000000028600000**
123	Middelbult 284 IS	1 5 6 9 10 12 13 16 26	Sasol Synfuels Pty Ltd	Urban Influence; Low Impact Industrial; Chemical Industry	**T0IS00000000028400001** **T0IS00000000028400005** **T0IS00000000028400006** **T0IS00000000028400009** **T0IS00000000028400010** **T0IS00000000028400012** **T0IS00000000028400013** **T0IS00000000028400016** **T0IS00000000028400026**
124	Middelbult 284 IS	3 Rem Ext	Nanini 357 CC	Urban Influence	**T0IS00000000028400003** **T0IS00000000028400000**
125	Middelbult 284 IS	7 20 21	Sasol Mining Pty Ltd	Urban Influence; Low Impact Industrial	**T0IS00000000028400007** **T0IS00000000028400020** **T0IS00000000028400021**
126	Middelbult 284 IS	8 15	Templemore Trading 69 CC	High Impact Industrial	**T0IS00000000028400008** **T0IS00000000028400015**
127	Middelbult 284 IS	17	HM Human	High Impact Industrial	**T0IS00000000013400000**

AFFECTED PROPERTIES SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT					
No.	**Property Name**	**Portion**	**Owner**	**Zoning Status**	**21 Digit Surveyor General ID Number**
128	Middelbult 284 IS	22	Eskom	Urban Influence	**T0IS00000000028400022**
129	Middelbult 284 IS	23	Eskom Holdings Ltd	Urban Influence	**T0IS00000000028400023**
130	Middelbult 284 IS	27 28 29	Municipality eMbalenhle	Medium Density Residential; Medium-High Density Residential; Open Space; Suburban Mixed Use; Institutional	**T0IS00000000028400027** **T0IS00000000028400028** **T0IS00000000028400029**
131	Driefontein 137 IS	2 6 12 22 23 25	Evander Gold Mines Ltd	Low-Medium Density Residential; Medium Density Residential; Medium-High Density Residential; Open Space; Quarrying & Mining; Low Impact Industrial; High Impact Industrial; Future Roads; General Mixed Use; Subsidised Housing	**T0IS00000000013700002** **T0IS00000000013700006** **T0IS00000000013700012** **T0IS00000000013700022** **T0IS00000000013700023** **T0IS00000000013700025**
132	Driefontein 137 IS	21	Ikaheng Prop Pty Ltd	Subsidised Housing; High Density Residential; Open Space; Future Roads; Institutional	**T0IS00000000013700021**
133	Sasolkraal 289 IS	1 2 Rem Ext	Sasol Synfuels Pty Ltd	Low Impact Industrial; Institutional; Urban Influence;	**T0IS00000000028900001** **T0IS00000000028900002** **T0IS00000000028900000**
134	Sasolkraal 289 IS	5	Municipality Secunda	Open Space	**T0IS00000000028900005**

AFFECTED PROPERTIES
SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT

No.	Property Name	Portion	Owner	Zoning Status	21 Digit Surveyor General ID Number
135	Twistdraai 285 IS	5 6 11 12 15 Rem Ext	Sasol Synfuels Pty Ltd	Chemical Industry; High Impact Industrial	**T0IS00000000028500005** **T0IS00000000028500006** **T0IS00000000028500011** **T0IS00000000028500012** **T0IS00000000028500015** **T0IS00000000028500000**
136	Brandspruit 318 IS	3	Sasol Synfuels Pty Ltd	High Impact Industrial	**T0IS00000000031800003**
137	Goedehoop 289 IS	5 7 8 14	Sasol Synfuels Pty Ltd	Chemical Industry; High Impact Industrial; Urban Influence	**T0IS00000000028900005** **T0IS00000000028900007** **T0IS00000000028900008** **T0IS00000000028900014**
138	Bosjespruit 291 IS	4	Sasol Synfuels Pty Ltd	Urban Influence; High Impact Industrial	**T0IS00000000029100004**
SPRINGBOKDRAAI RESERVE					
139	Rietkuil 531 IR	2	P F Louwrens Trust	Agriculture	**T0IR00000000053100002**
140	Rietkuil 531 IR	3 9	N F Nel Trust	Agriculture	**T0IR00000000053100003** **T0IR00000000053100009**
141	Rietkuil 531 IR	4 5	H B Louwrens Trust	Agriculture	**T0IR00000000053100004** **T0IR00000000053100005**
142	Rietkuil 531 IR	10	AT van Niekerk	Agriculture	**T0IR00000000053100010**
LEEUWPAN RESERVE					
143	Leeuwpan 532 IR	7 Rem Ext	Saltholdings (Pty) Ltd	Agriculture	**T0IR00000000053200007** **T0IR00000000053200000**
SHONDONI CONVEYOR ROUTE					
144	Leeuwspruit134 IS	Rem Ext	Evander Gold Mines Ltd	Agriculture	**T0IS00000000013400000**
145	Witkleifontein 131 IS	1	Sakhisiswe CPA	Agriculture	**T0IS00000000013100001**
146	Zandfontein 130 IS	2	Brendan Village	Agriculture	**T0IS00000000013000002**
147	Zandfontein 130 IS	3 8 9	Evander Gold Mines Ltd	Agriculture	**T0IS00000000013000003** **T0IS00000000013000008** **T0IS00000000013000009**
148	Zandfontein 130 IS	4	EL Du Plooy	Agriculture	**T0IS00000000013000004**

AFFECTED PROPERTIES
SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT

No.	Property Name	Portion	Owner	Zoning Status	21 Digit Surveyor General ID Number
149	Zandfontein 130 IS	6	Zandfontein MMC Eiendomme CC	Agriculture	**T0IS00000000013000006**
150	Grootspruit 279 IS	3 5 Rem Ext	Evander Gold Mines Ltd	Agriculture; Urban Influence	**T0IS00000000027900003** **T0IS00000000027900005** **T0IS00000000027900000**
151	Grootspruit 279 IS	7	JC Els	Agriculture; Open Space	**T0IS00000000027900007**
152	Grootspruit 279 IS	2 9 10	Govan Mbeki Local Municipality	Agriculture; Urban Influence; Open Space; Agriculture	**T0IS00000000027900002** **T0IS00000000027900009** **T0IS00000000027900010**
153	Grootspruit 279 IS	8 11	Republic of South Africa	Open Space; Municipal Commonage; Medium Density Residential; High Impact Industrial; Suburban Mixed Use	**T0IS00000000027900008** **T0IS00000000027900011**
154	Rietkuil 283 IS	6 7	Republic of South Africa	Urban Influence; Agriculture	**T0IS00000000028300006** **T0IS00000000028300007**
155	Branddrift 322 IS	2	Sasol Mining Pty Ltd	Agriculture	**T0IS00000000032200002**
156	Branddrift 322 IS	3	Delevex 47 CC	Agriculture	**T0IS00000000032200003**
157	Branddrift 322 IS	12	Republic of South Africa	Agriculture	**T0IS00000000032200012**
158	Branddrift 322 IS	14	Hendrico Landgoed Pty Ltd	Agriculture	**T0IS00000000032200014**
159	Rietvley 320 IS	1	Hendrico Landgoed Pty Ltd	Agriculture	**T0IS00000000032000001**
160	Rietvley 320 IS	8	A Jiyane	Low Impact Industrial	**T0IS00000000032000008**
161	Rietvley 320 IS	2 3 Rem Ext	Sasol Synfuels Pty Ltd	Low Impact Industrial	**T0IS00000000032000002** **T0IS00000000032000003** **T0IS00000000032000000**
162	Brandspruit 318 IS	3	Sasol Synfuels Pty Ltd	High Impact Industrial	**T0IS00000000031800003**
163	Twistdraai 285 IS	3 4	Sasol Synfuels Pty Ltd	High Impact Industrial; Urban Influence	**T0IS00000000028500003** **T0IS00000000028500004**
SHONDONI SHAFT					
164	Leeuwspruit134 IS	Rem Ext	Evander Gold Mines Ltd	Agriculture	**T0IS00000000013400000**
165	Witkleifontein 131 IS	1	Sakhisiswe CPA	Agriculture	**T0IS00000000013100001**
166	Zandfontein 130 IS	4	EL Du Plooy	Agriculture	**T0IS00000000013000004**
ITHEMBALETHU SHAFT					

AFFECTED PROPERTIES SASOL MINING MIDDELBULT (BLOCK 8) - SHONDONI PROJECT					
No.	**Property Name**	**Portion**	**Owner**	**Zoning Status**	**21 Digit Surveyor General ID Number**
167	Zandfontein 130 IS	2	Brendan Village	Agriculture	**T0IS00000000013000002**
WEST SHAFT					
168	Grootspruit 279 IS	17	Sasol Mining Pty Ltd	Agriculture	**T0IS00000000027900017**
MAIN SHAFT					
169	Middelbult 284 IS	7	Sasol Mining Pty Ltd	Low Impact Industrial	**T0IS00000000028400007**
NORTH WEST SHAFT					
170	Langverwacht 282 IS	6	Govan Mbeki Local Municipality	Medium Density Residential	**T0IS00000000028200006**
NORTH SHAFT					
171	Sasolkraal 289 IS	Rem Ext	Sasol Synfuels Pty Ltd	Low Impact Industrial; Institutional; Utility; Urban Influence;	**T0IS00000000028900000**

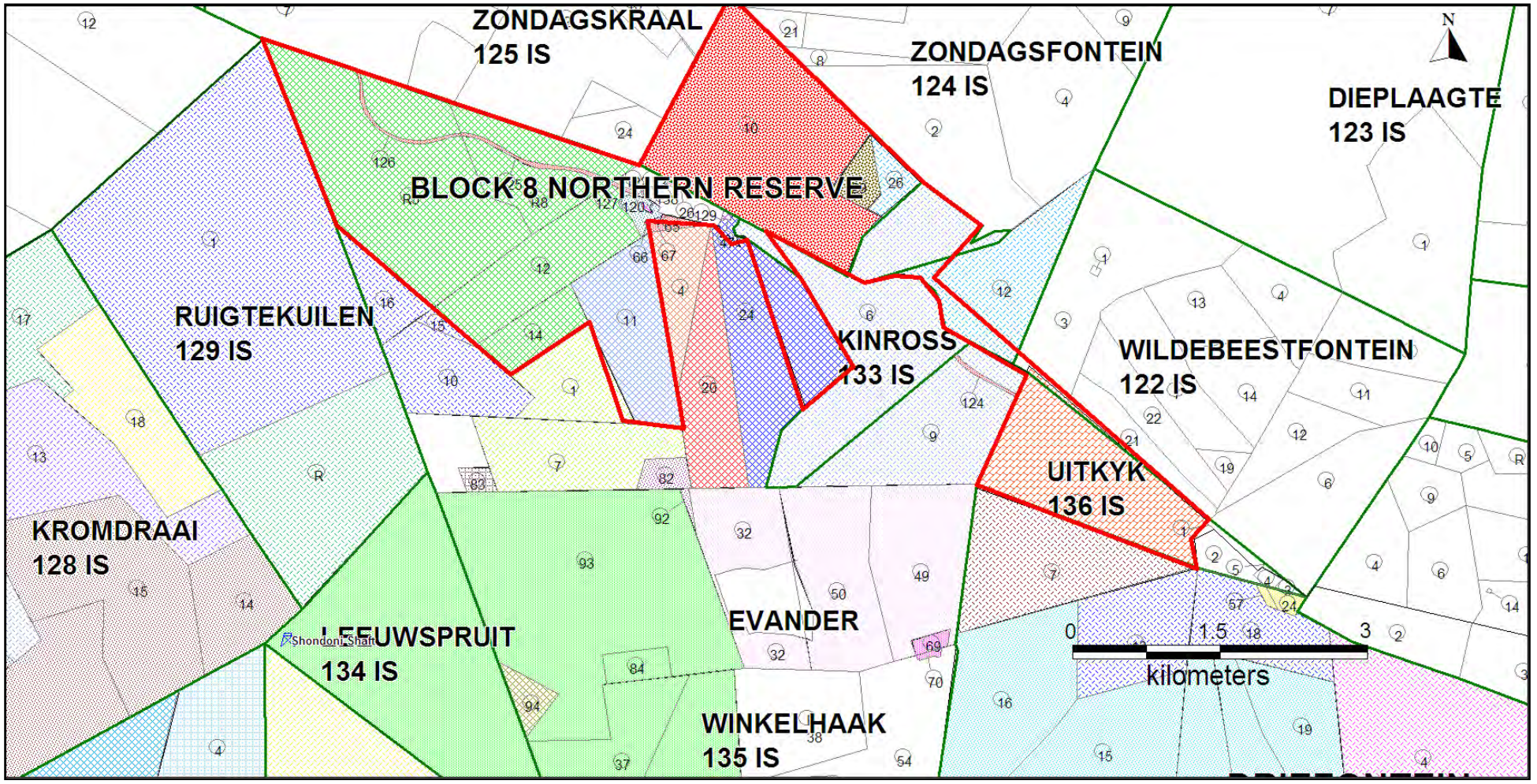


Figure 4.5(a): Block 8 Northern Reserve Properties

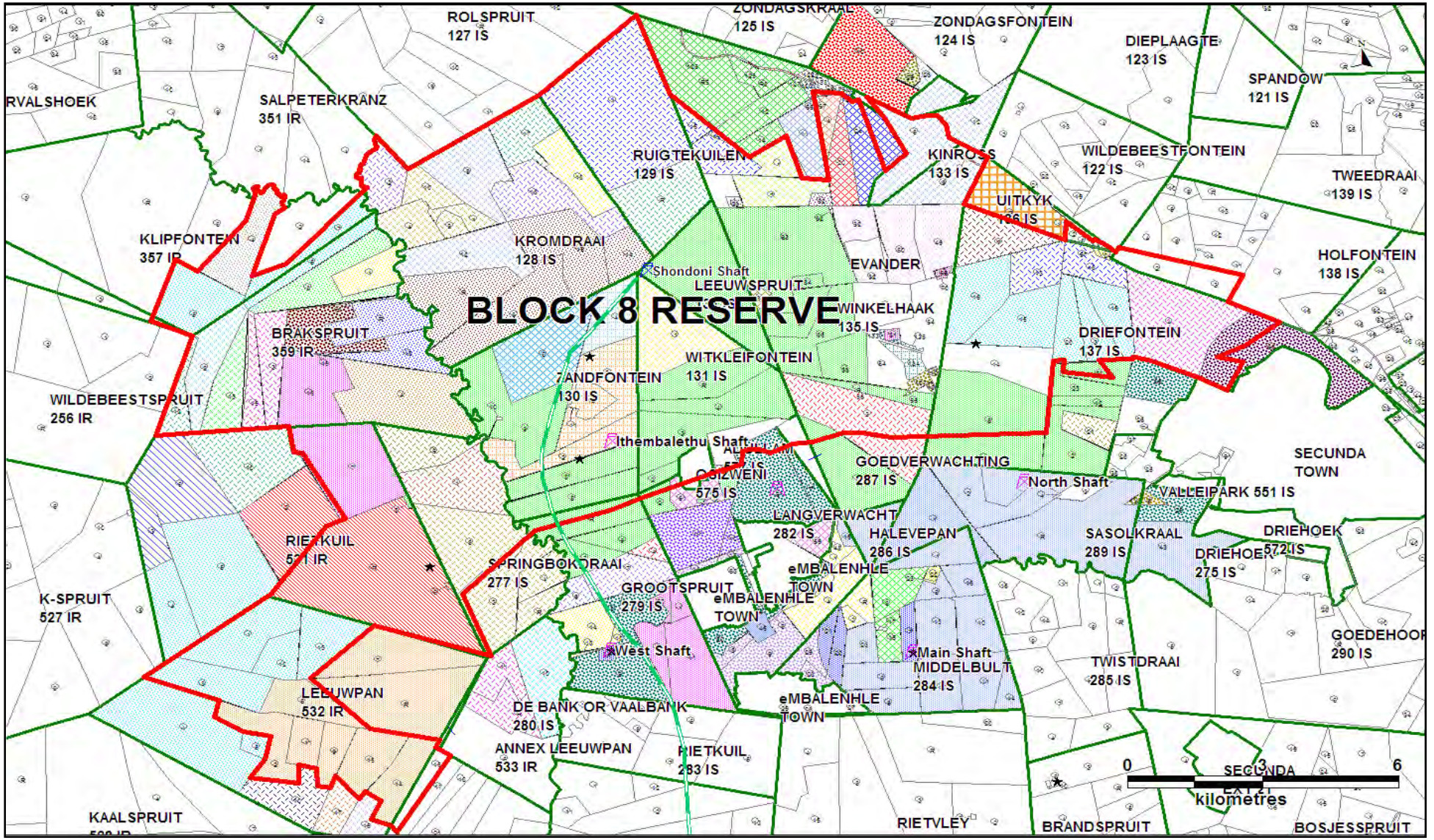


Figure 4.5(b): Block 8 Reserve Properties

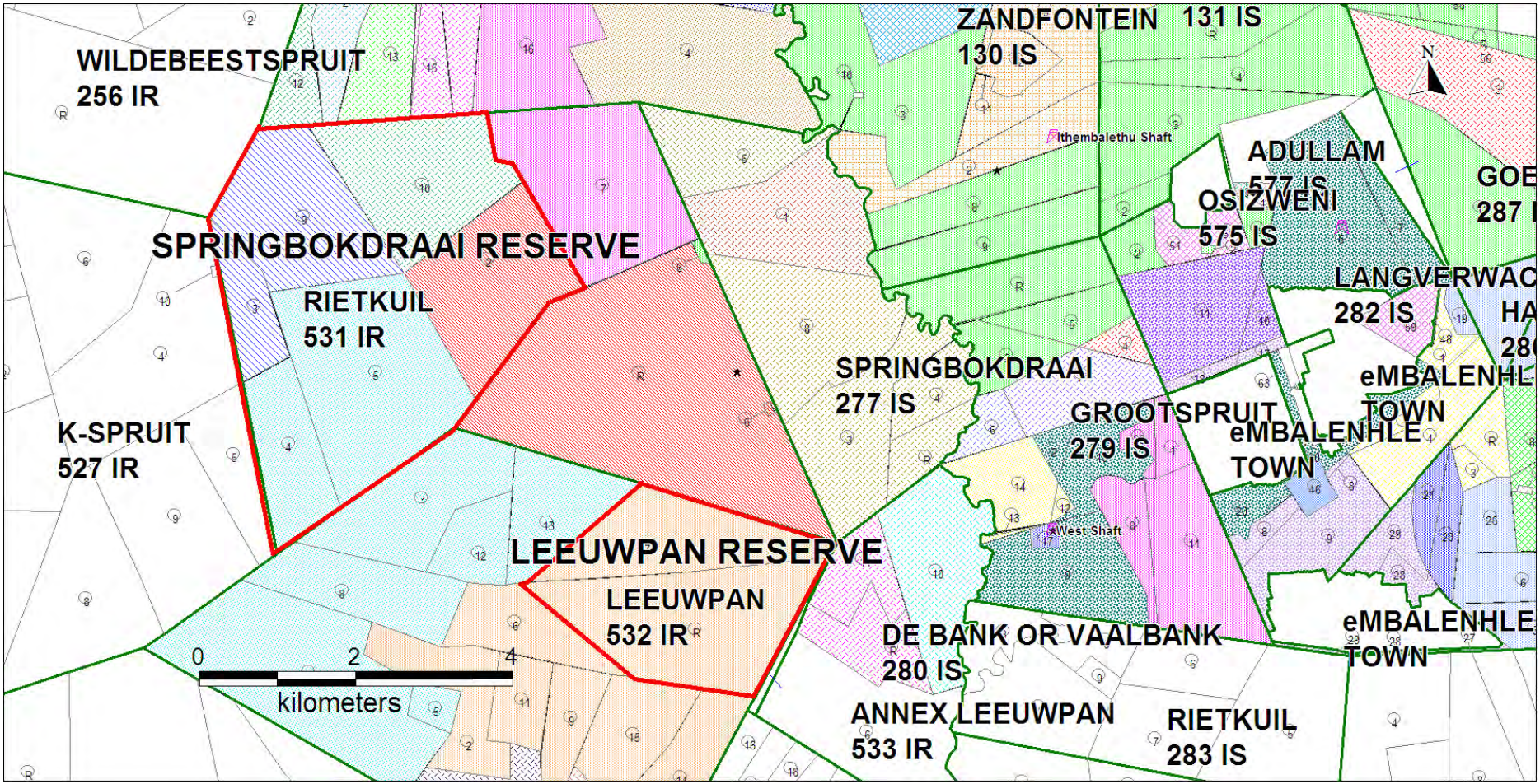


Figure 4.5(c): Springbokdraai Reserve and Leeuwpan Reserve

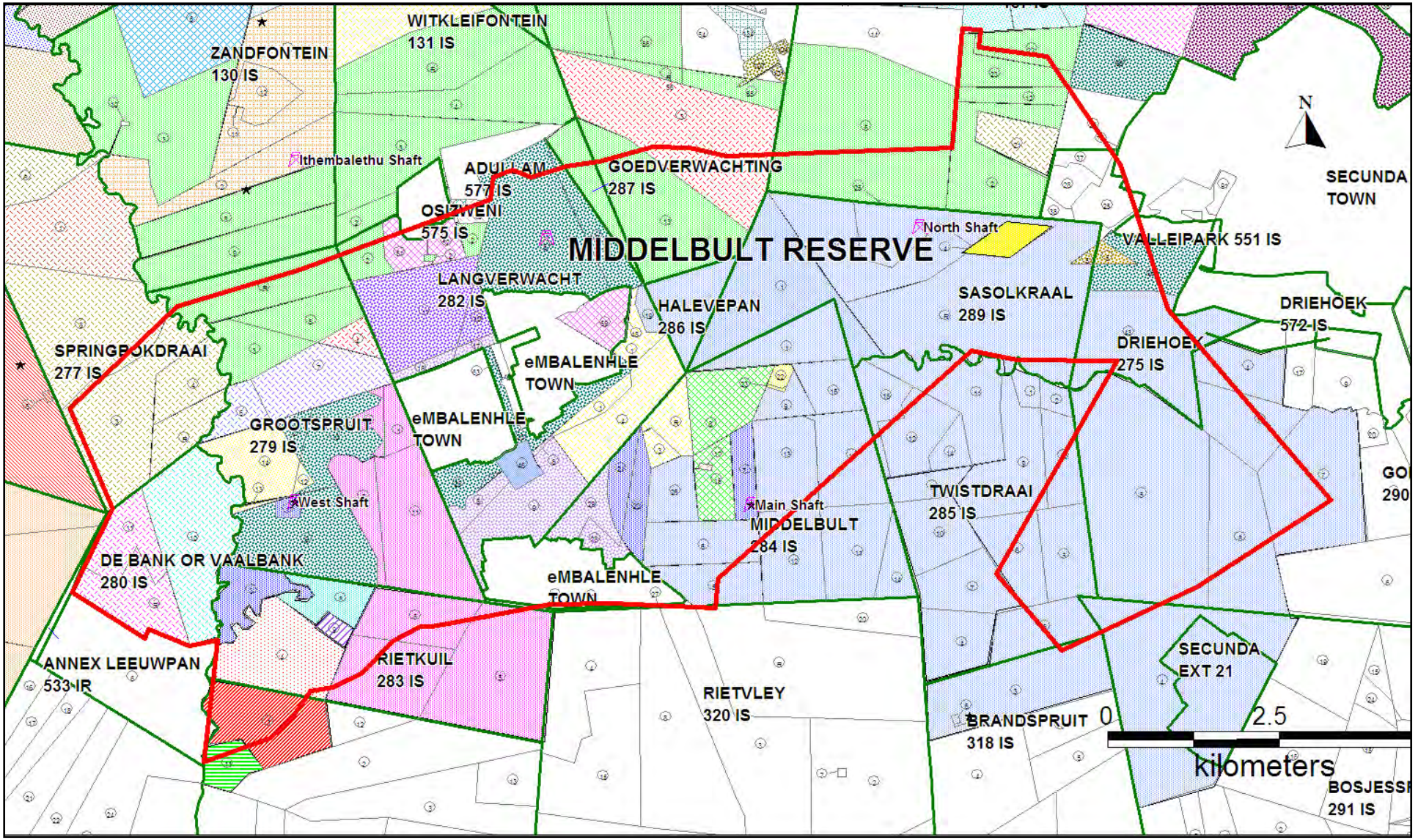


Figure 4.5(d): Middelbult Reserve Properties

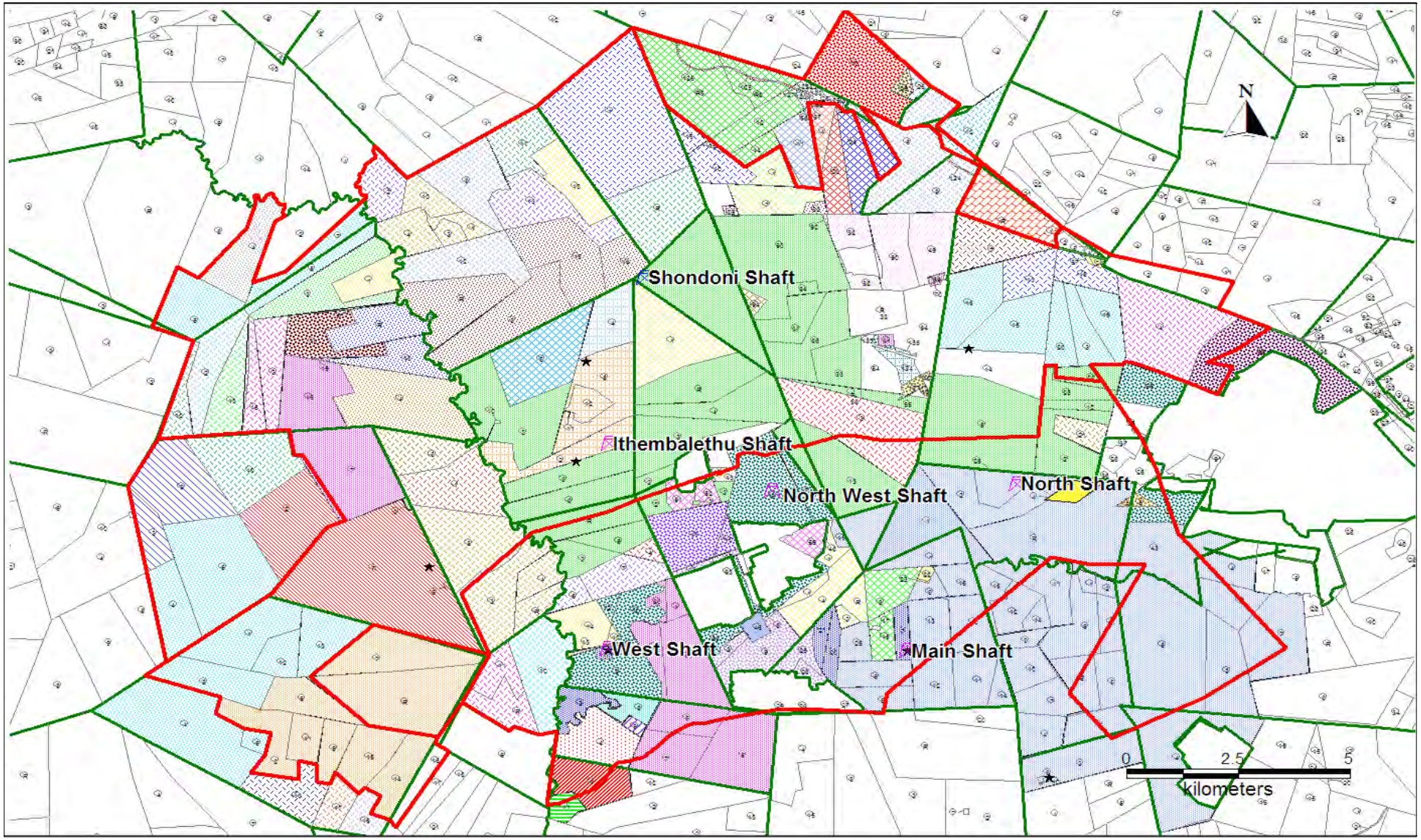


Figure 4.5(e): Middelbult – Block 8 – Shondoni Shaft Position Properties

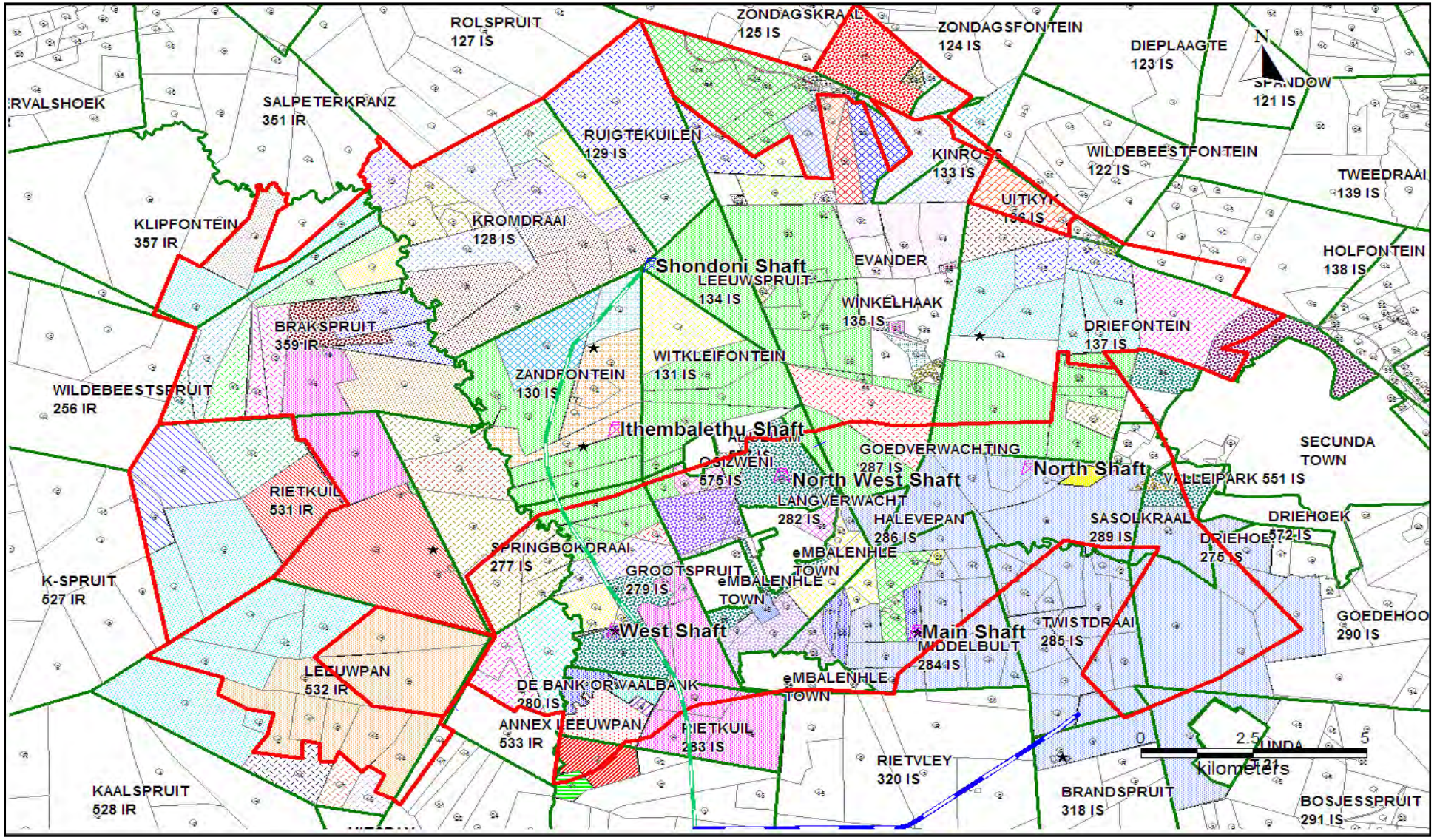


Figure 4.5(f): Shondoni Conveyor Route Properties

4.6 PROJECT RESOURCE ATTRIBUTES

4.6.1 Mineral Deposit

The geology of the area consists of mainly sedimentary and igneous strata of the Witwatersrand, Ventersdorp, and Transvaal Supergroups; as well as igneous rock from the Bushveld Complex, which subcrops along the sandstone/siltstone base of the Karoo Supergroup. The base of the Karoo consists of tillite overlain by sandstone and siltstone of the Pietermaritzburg Formation, which in turn overlain by sediments from the Vryheid Formation. Between the upper sandstone\siltstone layers a number of coal seams have developed (C2, C3, C4L, C4U and No. C5 Coal Seams). The coal is of a low-grade bituminous quality occurring in horizontal seams.

4.6.2 Mineable Seams

Of the Coal Seams mentioned, only the No. C2 and the No. C4L Coal Seams are mineable within the Middelbult/Block-8/Leeuwpan/Springbokdraai/Block-8 Northern Reserves.

Historic Mining at Middelbult Colliery, performed under previous existing authorizations, extracted primarily from the C4L Seam.

Specifically for this authorization project, related to the Shondoni Shaft, both the No. C2 and the No. C4L Coal Seams will be mined.

4.6.3 Depth Below Surface and Dip

The average depth to the No. C4L Coal Seam is some 117 m below ground surface. The No. C2 occurs some 20 m – 30 m deeper. Mining depths to date varied and is estimated in future to vary in the new sections between 70 m to 160 m below surface.

4.6.4 Inferred/Proven Reserves

The existing mineable coal reserves in the original Middelbult Mining Area (excluding Block 8, Leeuwpan, Springbokdraai and the Block 8 Northern Reserves) has largely been mined. The Block 8 reserve area, including Leeuwpan, Springbokdraai and Block 8 Northern Reserves) contains in excess of 370 million tons of Run of Mine (ROM - mineable) coal.

4.6.5 Coal Quality

The coal is of a low-grade bituminous quality.

4.6.6 Product Market

The mined and crushed coal will be brought to surface at Shondoni Shaft from where it will be transported by conveyor to link up with the southern Brandspruit Mine conveyor and then onto the stockpiles at the existing Sasol Coal Supply

(SCS) area, from where it will be transported directly into the Sasol Synfuels Plant at Secunda.

4.6.7 Planned Production Rates

The planned production rate for Middelbult Colliery from all shafts (including Shondoni) is estimated to be between 8.5 million and 9.5 million tons of ROM coal per year.

4.6.8 Planned Life of Mine

The Shondoni Project will increase the Middelbult Colliery Life of Mine until the year 2041.

4.7 PROJECT MOTIVATION

4.7.1 Legal Standing

Middelbult Colliery is a part of the well established Sasol Mining Group, which is legally authorized to mine coal from the Middelbult and Block 8 Reserves. Middelbult Block 8 holds an approved EMPR and EMPR Addendum and is in possession of the relevant required Mining Authorisations from DME (now DMR). The proposed Shondoni project relates primarily to the establishment of additional infrastructure (shaft complex, conveyor, powerline etc.) to optimally extract the already authorized reserves.

However, as part of this application, three additional reserve blocks, known as Block 8 Northern Reserves, Springbokdraai and Leeuwpan, will also be applied for. The existing and proposed additional reserves for Middelbult (Block 8) Shondoni Project are indicated on Figure 3.7.1(a).

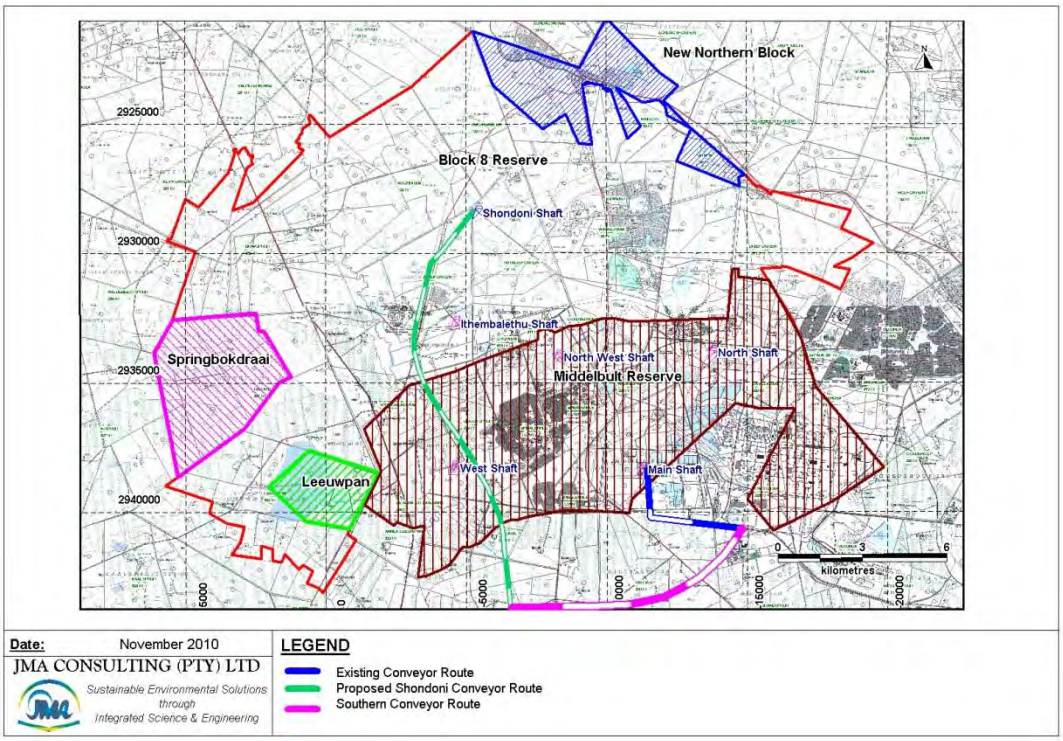


Figure 4.7.1(a): Existing Middelbult (Block 8) reserves, together with new Reserve Blocks (Block 8 Northern Reserves, Spingbokdraai and Leeuwpan) applied for

4.7.2 Need for Product

The coal produced by Middelbult – Shondoni contributes a significant portion of the critically required feed into the Sasol Synfuels Plant at Secunda. The sustained maintenance of the coal mining production rates to source the SSF Plant is of the utmost importance.

4.7.3 Strategic Importance of the Resource/Product

Sasol Synfuels in Secunda arguably represents one of the single most strategic industries in South Africa. Without quoting figures, it is obvious that its contribution to the supply of the national liquid petroleum, industrial chemical and agricultural chemical markets, to name but a few of the more obvious, is of national strategic significance.

4.7.4 Contribution to Gross Domestic Product

The exiting Middelbult Mine has contributed to the South African GDP since the 1990's. The expansion of the Middelbult mining operations into the Block 8, Springbokdraai, Leeuwpan and Block 8 Northern Reserves will contribute significantly to the GDP. Estimates in 2003, puts a shaft development cost, similar to what is envisaged at Shondoni, at an estimated R 900 million. The annual expense budget estimated in 2003, puts annual expenditure during full production at some R 700 million per year.

4.7.5 Contribution to Foreign Earnings

Although none of the Middelbult Shondoni coal will be sold directly into the foreign markets, the indirect contribution to the South African Balance Sheet is obvious due to the significant contribution to the local economy via the Sasol Synfuels contribution to fuel and chemicals supply.

4.7.6 Socio-Economic Benefits

Middelbult - Block 8 - Shondoni), as part of the overall mining and industrial industry in the Govan Mbeki Municipal Area, contributes quite significantly to the socio-economic wellbeing of the region. Studies conducted in the area clearly show the dominant contribution of the mining and associated industrial sectors to the socio-economic fabric of the area. The influence of the mining and industrial sectors clearly manifest in aspects related to age distribution, employment, income and the provision of services and housing.

The number of people employed in the Govan Mbeki Municipality amounts to some 67 172 people (or 32 % of the total population). Not reflected in these figures is the amount of informal employment within the district. In a study conducted by DPR (2000), the number of people involved in the informal employment sector in the Highveld Ridge District was ±7 000.

Information available for the various sectors of the economy and the number of people employed in these sectors, indicate that mining accounts for the highest number of employees at 9,54% (20 018 people) followed by manufacturing at 4,35% (9 130 people). However, these figures only reflect the direct employment in these sectors and do not account for the peripheral employment created around these sectors.

The Middelbult - Block 8 - Shondoni workforce of 1600 employees represents some 8 % of the total mining sector workforce in the area.

4.8 DETAILED PROJECT DESCRIPTION

Although this current project represents an application for authorization of a mining activities related to the new Shondoni Shaft Complex for Middelbult Colliery, the description to follow will provide details for the entire Middelbult Colliery operation, including information contained in the previously approved EMPR (2002) and EMPR Addendum (2004) for the mine. The motivation for this is to support integrated environmental management between both the existing, as well as the proposed new operations, at Middelbult-Block 8-Shondoni.

The Middelbult - Block 8 Mine currently comprises of 5 authorized Shafts, of which two are already closed. Four of these shafts are located within the original Middelbult Reserve:

- **Main Shaft** – still operational
- **West Shaft** – still operational
- **North Shaft** – closed
- **North-West Shaft** – closed

The fifth shaft is:

- **iThemba lethu** Shaft

This shaft is located in the Block 8 Reserves, which was authorized with the Block 8 EMPR Addendum in 2004.

The current project comprises the development of the new **Shondoni Shaft** Complex in the Block 8 Reserves, the construction and commissioning of a conveyer belt system to transport the coal to link up with an existing Conveyor in the south, and then on to Sasol Coal Supply (SCS, the central coal stockpiles) and the associated development of underground bord and pillar and high extraction mining on the No.C4L and No. C2 Coal Seams.

The localities of the existing shafts, the locality of the proposed Shondoni Shaft, the delineations of the Middelbult Reserves, Block 8 Reserves, Block 8 Northern Reserves, Springbokdraai Reserves and the Leeuwpan Reserves, as well as the alignments of the existing Middelbult Conveyor and the proposed new Shondoni Conveyor, is shown on Figure 4.8(a).

The historic mining on the No. C4L seam (red areas in Middelbult and Block 8 Reserves), as well as the proposed new mining on the No. C4L seam (blue areas in Block 8, Leeuwpan and Springbokdraai Reserves) are shown on Figure 4.8(b).

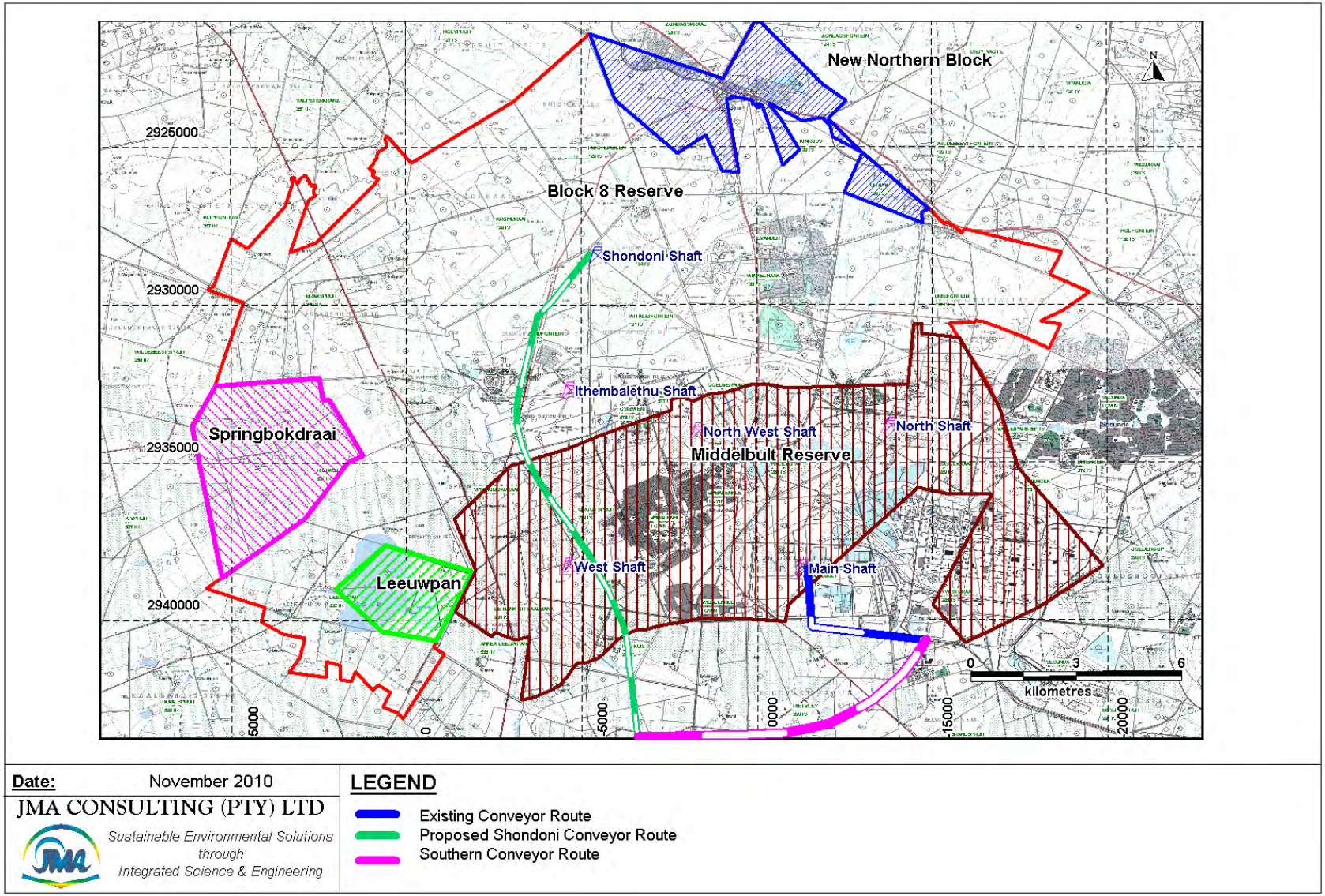


Figure 4.8 (a): The Middelbult-Block 8-Shondoni Surface Plan

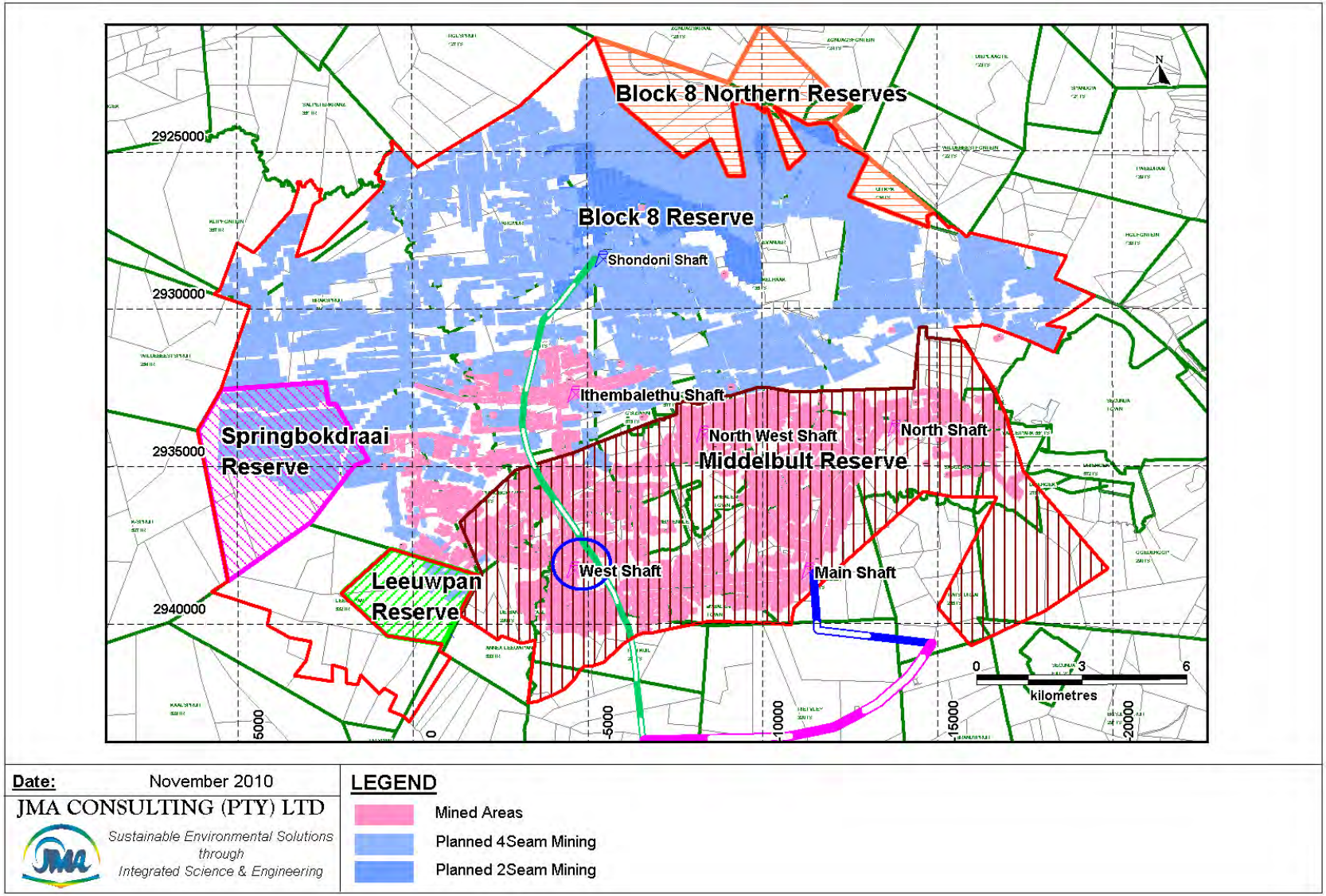


Figure 4.8 (b): The Middelbult-Block 8-Shondoni Underground Mining Plan (No. C4L and No. C2 Coal Seam)

4.8.1 Existing Middelbult-Block 8 Surface Infrastructure

The surface infrastructure layouts for the five existing shafts at Middelbult-Block 8 are shown in Figure 4.8.1(a) to Figure 4.8.1(e) below.

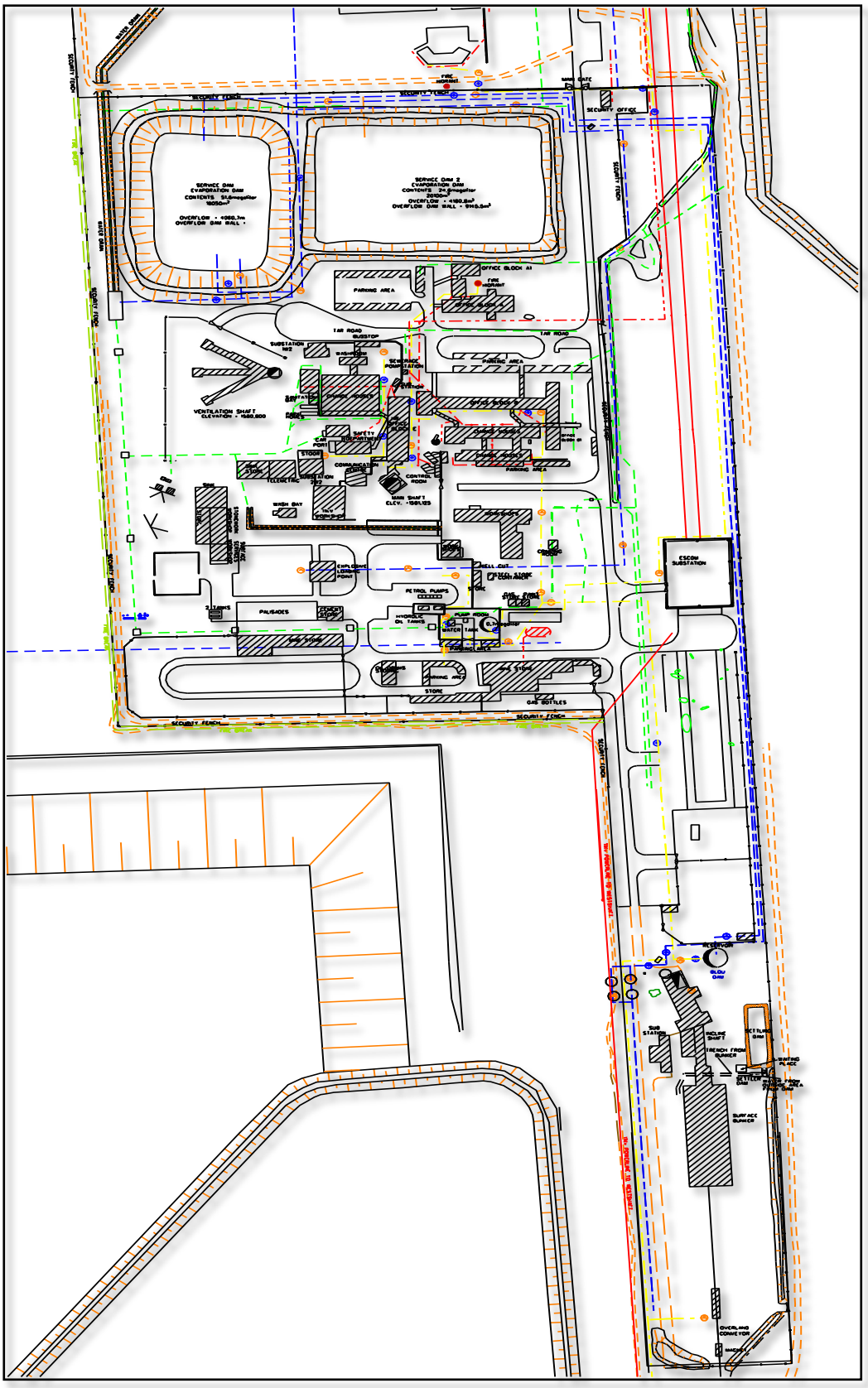


Figure 4.8.1(a): Surface Layout for Middelbult Main Shaft

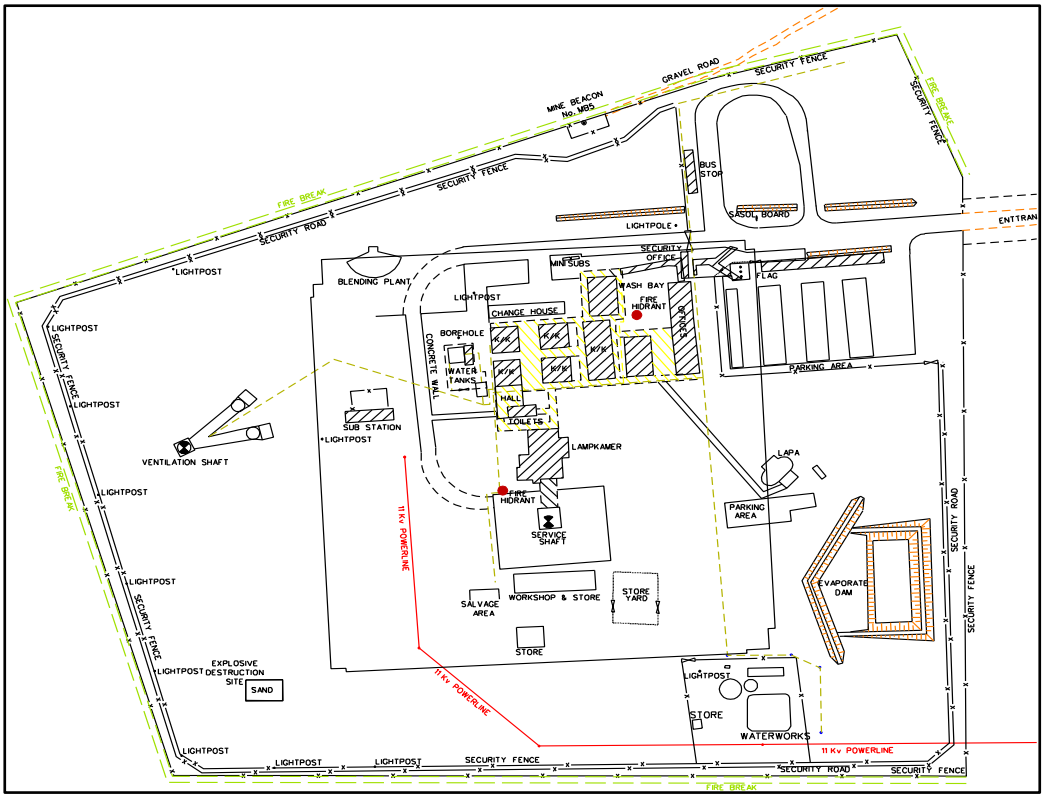


Figure 4.8.1(b): Surface Layout for Middelbult West Shaft

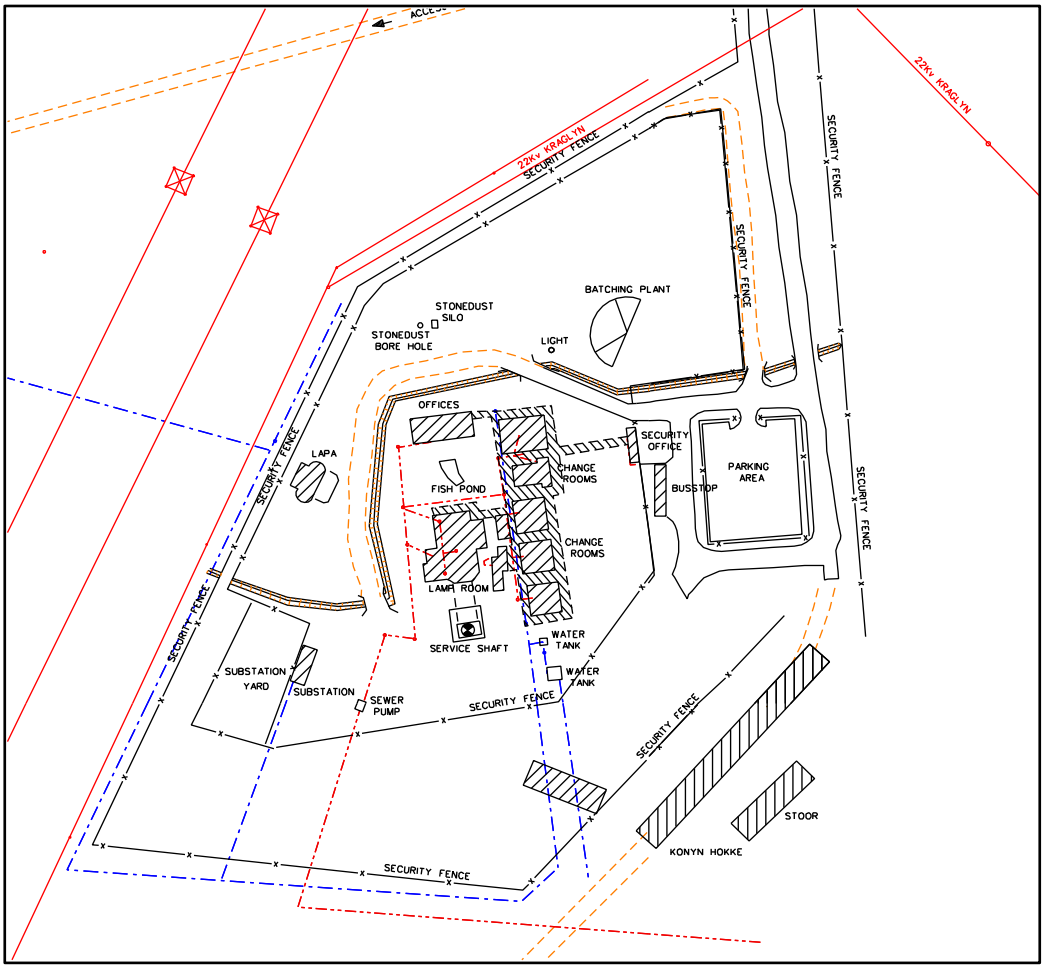


Figure 4.8.1(c): Surface Layout for Middelbult North Shaft

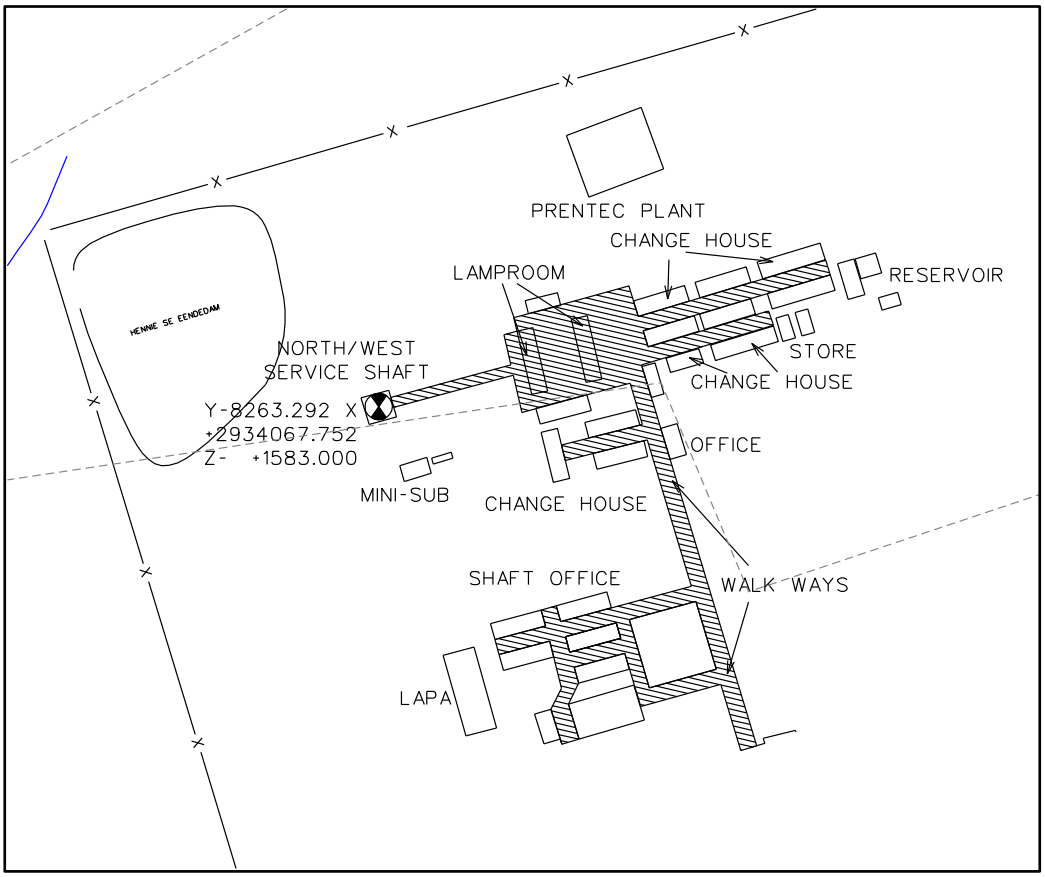


Figure 4.8.1(d): Surface Layout for Middelbult North-West Shaft

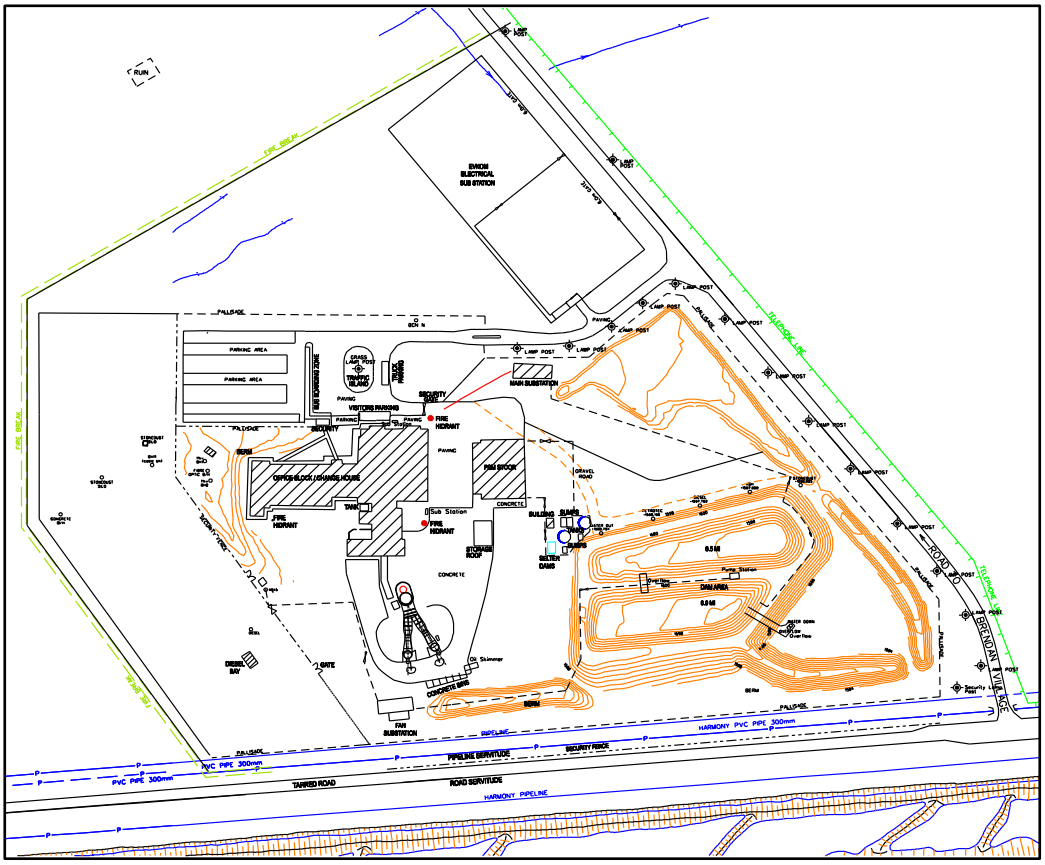


Figure 4.8.1(e): Surface Layout for Middelbult iThemba lethu Shaft

4.8.1.1 Shaft Surface Infrastructure

A summary of surface infrastructure at the existing Middelbult-Block 8 Operations are shown in Table 4.8.1.1(a) below. All shaft complexes are located within fenced secondary security areas.

Table 4.8.1.1(a): Surface Infrastructure at existing Middelbult Shafts

Infrastructure	Main Shaft	North Shaft	West Shaft	North West Shaft	iThemba lethu Shaft
Service Shaft with Headgear	X	X	X	X	X
Ventilation Shaft and Equipment	X	X	X		X
Offices	X	X	X	X	X
Change Houses	X	X	X	X	X
Lamp Room	X	X	X	X	X
Electrical Substation	X	X	X	X	X
Workshops	X				X
Parking and Roads	X	X	X	X	X
Service Water Dams/Reservoir/Towers	X	X	X	X	X
Incline Shaft	X				
Surface Coal Storage Bunker	X				
Storm Water Control System	X		X	X	
Sewage Treatment Plant			X	X	X
Pollution Control Dam	X		X	X	
Stone Dust Silo		X	X	X	
Ash Plant		X	X	X	

4.8.1.2 Access Roads

The Main Shaft Complex is accessed along a 3 km constructed tar road with a T-junction from the P185 Standerton-Evander road. The North Shaft is linked by a tar road to the P216-1 Vaal-Trichardt road. The West Shaft is accessed along a tar road from the R546 road. North-West shaft is accessed from a tar road from the R546 road whilst the iThemba lethu Shaft is accessed by a tar road from the R547.

4.8.1.3 Offices/Workshops/Change Houses

All existing shafts have office buildings, of which the buildings at i Themba Lethu are the most modern – see Figure 4.8.1.3(a) below. Whilst change houses exist at all the shafts, only Main Shaft, West Shaft and iThemba Lethu Shaft have workshops on surface.

Figure 4.8.1.3(a): Office complex at Thubelisha

4.8.1.4 Internal Roads and Parking Areas

Internal roads and parking areas at the existing shafts are either tarred or paved. Other open areas are grassed with kikuyu lawns. The photograph depicted in Figure 4.8.1.4(a) shows the extent and type of paving used at iThemba lethu.

Figure 4.8.1.4(a): Paving used at iThemba lethu Shaft

4.8.1.5 Electrical Substations

All existing Shafts are supplied with ESKOM Power. Main Shaft and North Shaft have separate incoming lines. The power is distributed from electrical substations to supply the underground workings as well as the surface infrastructure.

A typical electrical sub-station, (the one at iThemba lethu Shaft is shown in Figure 4.8.1.5(a). Power is distributed both with underground cables as well as with overland power lines (from Main Shaft and North Shaft to other satellite shafts).

Figure 4.8.1.5(a): Electrical Sub-Station at i Themba Lethu Shaft

4.8.1.6 Fuels Storage

The Main Shaft is the only existing shaft with fuel storage on surface. Fuel is stored in a 50 000 l diesel tank and a 14 000 l oil tank. The tanks are located above ground and are located on a concrete lined footprint within a bunded area.

4.8.1.7 Soils/Overburden Stockpiles

Soils removed during the topsoil stripping prior to construction of the surface infrastructure was stock piled, whilst rock overburden material removed during shaft sinking was used to construct perimeter berms in the shaft area as well as storm water flow management berms. Once the berms were constructed, the stock piled soil was used to cover all berms and levelled areas, after which they were grassed.

4.8.1.8 Housing

No housing is provided as part of the Middelbult-Block 8 existing mining operations. All employees live in private dwellings within the greater Secunda – Trichardt – Evander – eMbalenhle area.

4.8.1.9 Recreational Facilities

Middelbult-Block 8 does not provide any mine based recreational facilities. Sufficient private and municipal recreational facilities are available in the greater Secunda – Trichardt – Evander – eMbalenhle area.

4.8.2 Existing Middelbult-Block 8 Mining Infrastructure

4.8.2.1 People and Material Shafts

All of the existing Shaft Complexes have vertical people and material shafts, whilst only Main Shaft has an incline shaft with a coal conveyor from underground as this is the only existing shaft where coal is brought to surface. A typical vertical people and material shaft (iThemba lethu) is shown on the photograph in Figure 4.8.2.1(a).

Figure 4.8.2.1(a): Typical Vertical People and Material Shaft

4.8.2.2 Ventilation Shafts

Ventilation shafts are required to ventilate the underground mine workings. The shafts are usually constructed through raise boring from underground and the surface infrastructure comprises a shaft exit together with extraction equipment.

With the exception of North-West Shaft, all the other existing shaft complexes have ventilation shafts.

Typical ventilation shaft surface infrastructure is shown on the photograph in Figure 4.8.2.2(a). Sometimes, the ventilation shaft and the people and material shaft is located within the same excavation, as is the case at iThemba lethu. See Figure 4.8.2.1(a) above. However, ventilation shafts can also exist separate from the service shaft within the same shaft complex. Ventilation shafts located in remote areas away from the service shaft complexes are referred to as satellite shafts.

Figure 4.8.2.2(a): Typical Ventilation Shaft Surface Infrastructure

4.8.2.3 Underground Mining Method

The primary mining method used at Middelbult-Block 8 is bord and pillar mining. High extraction is performed when portions of pillars are removed upon retreat out of a particular section. High extraction could lead to roof collapse which could in turn cause surface subsidence and has specific water management related implications. High extraction is only performed in pre-selected mining areas. The diagram shown in Figure 4.8.2.3(a) represents a planned view of the underground workings, portraying the roads, pillars and working faces. The utilization of stone work to manipulate air flow is also shown. Of further and particular significance is to observe the large mass of coal not extracted during bord and pillar mining, which also illustrates the requirement for high extraction to optimize extraction of the coal seams.

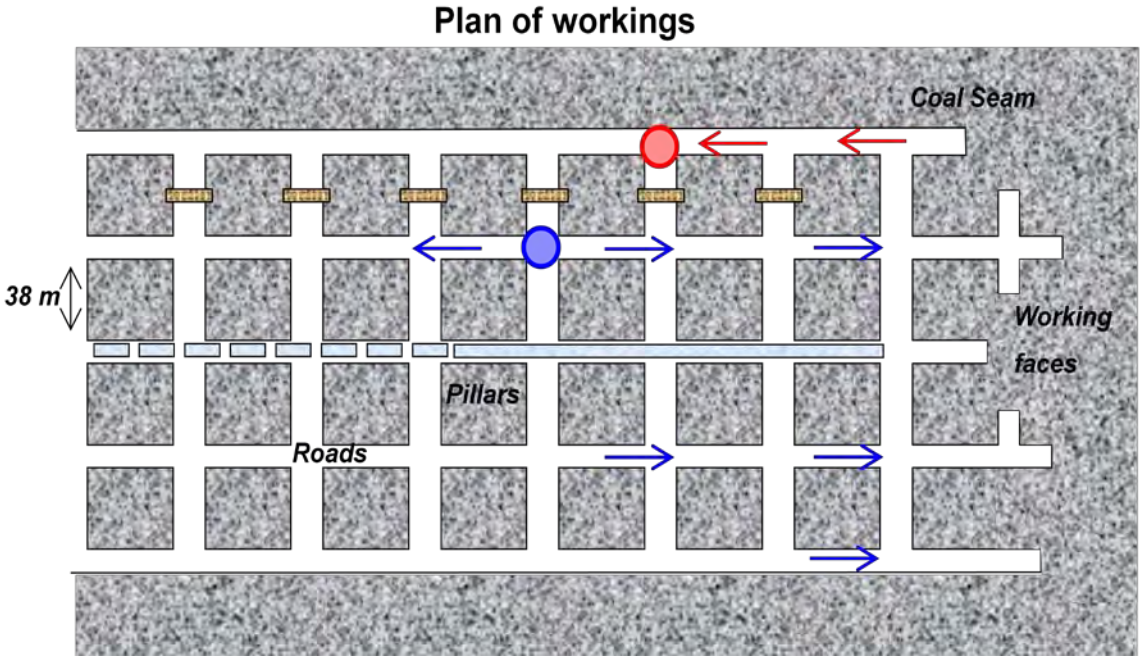


Figure 4.8.2.3(a): Plan View of Underground Workings

4.8.2.4 Underground Mining Equipment

Underground coal mining at Middelbult-Block 8 is currently conducted with continuous miners (CMs). Coal is cut with the continuous miners and loaded onto the shuttle cars to transport it from the working faces. Roof support is also installed on a continuous basis to stabilize the roof against collapse. The photo collage shown in Figure 4.8.2.4(a), depicts a continuous miner, a shuttle car and the roof support equipment.

Figure 4.8.2.4(a): Typical Underground Mining Equipment

4.8.2.5 Underground Sequential Mining Plan

The underground mining plan shown in Figure 4.8.2.5(a) below, is the most recent mining plan for Middelbult-Block 8, but also shows the planned extraction for the Leeuwpan and Springbokdraai Reserves. The areas indicated in **red** represent areas where mining has been completed, the **light blue** represents proposed mining on the C4L seam and the **darker blue** shows mining on the underlying C2 seam where it is not blanked out by the C4L seam workings.

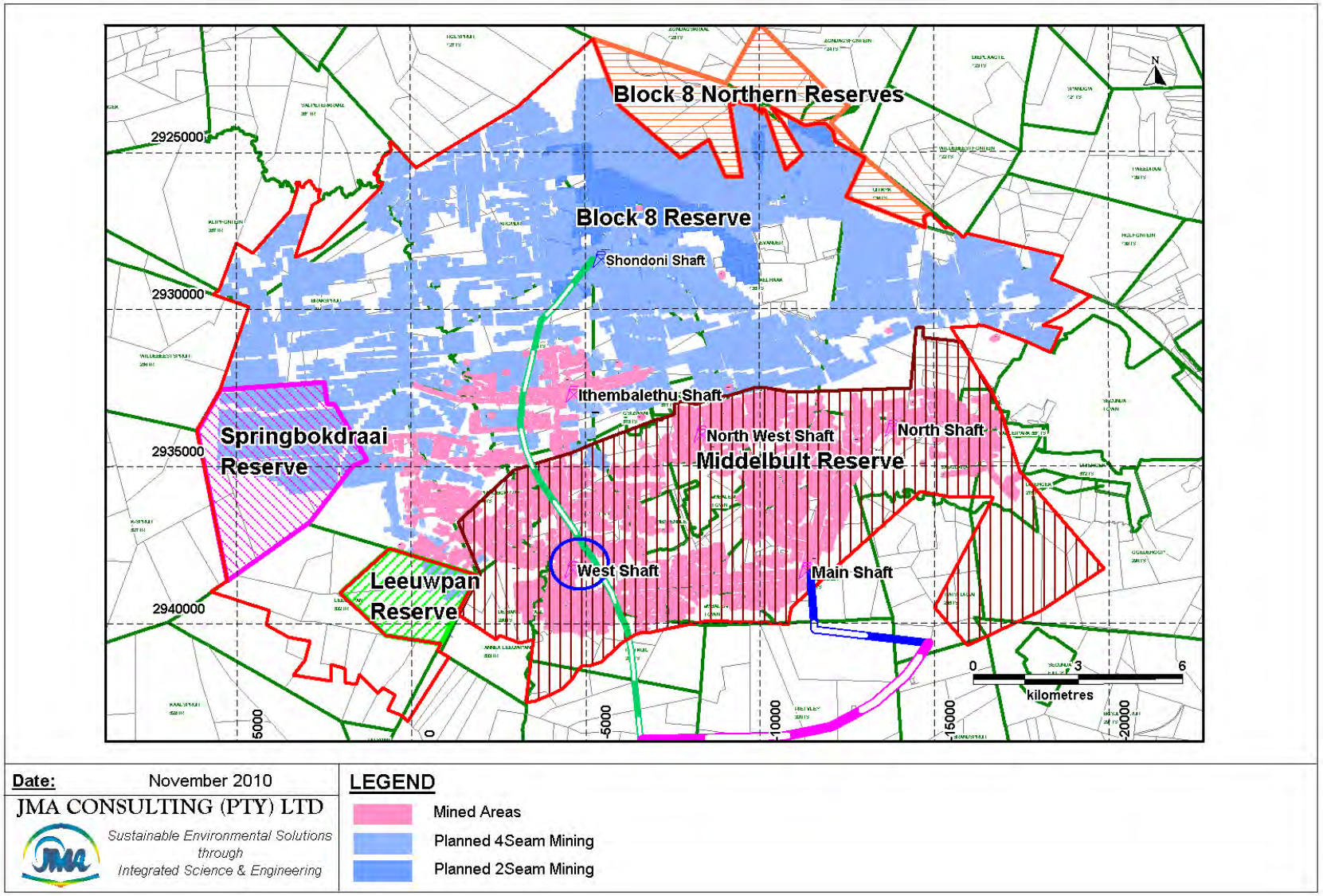


Figure 4.8.2.5(a): The Middelbult-Block 8-Shondoni Underground Mining Plan (No. C4L and No. C2 Coal Seam)

4.8.3 Coal Storage

Coal is currently brought out of the Middelbult-Block 8 underground mine only at the Main Shaft through an incline shaft with an underground coal conveyor. Once on surface at the Shaft Complex, the ROM coal is stored in a surface bunker. This storage is an intermediate step in the coal conveyance as it merely represents a buffer and a transfer station in order to feed the overland coal conveyer which transports the coal from Middelbult Main Shaft to the existing Sasol Coal Supply (SCS the central coal stockpile area).

The surface bunker is an enclosed concrete structure but also has an emergency coal throw out area adjacent to it. The throw out area is an emergency stockpile area and is not allowed to exist as a matter of routine operation. A typical surface coal bunker and its associated surface throw out area is depicted in Figure 4.8.3(a).

Figure 4.8.3(a): Typical Surface ROM Coal Bunker & Throw out

4.8.4 Coal/Water/Electricity Conveyance and Reticulation

4.8.4.1 Coal Conveyor Belt

All coal mined currently at Middelbult-Block 8 is conveyed underground on conveyors to Main Shaft where it is taken to surface through an incline shaft. On surface the coal goes into the surface coal bunker from where it is deposited onto the existing surface coal conveyor which transports the coal to the Sasol Central Stockpile area.

The existing conveyor route from the Main Shaft is indicated as the vertical blue line running from Main Shaft in a southerly direction and then joining up with the blue line from the west to run in an easterly direction to the Sasol Central Coal Stockpiles. (See Figure 4.8.4.1(a)).

4.8.4.2 Water Conveyance

Potable water is supplied to all the Middelbult-Block 8 Shafts from Rand Water pipelines. All affected mine water is conveyed underground through the workings.

4.8.4.3 Electricity

Electrical Power is supplied to the current operations through surface ESKOM Power Lines from the SOL sub-station. Internal power distribution occurs either as 11 kV overland power lines or else through the underground workings.

4.8.5 Servitudes/Pipe Lines/Power Lines

Servitudes are registered for all pipelines, power lines and other infrastructure which cross or occur on non Sasol Mining property. Care is taken to optimize servitude usage through multi use.

4.8.6 Mineral Processing Plant

All ROM coal from Middelbult-Block 8 is conveyed to, stored and then pre-processed at Sasol Coal Supply (SCS), the central coal stockpile area within the Sasol Secunda Secondary Area. None of these activities fall within the Environmental Authorisation ambit of the Middelbult-Block 8 operations.

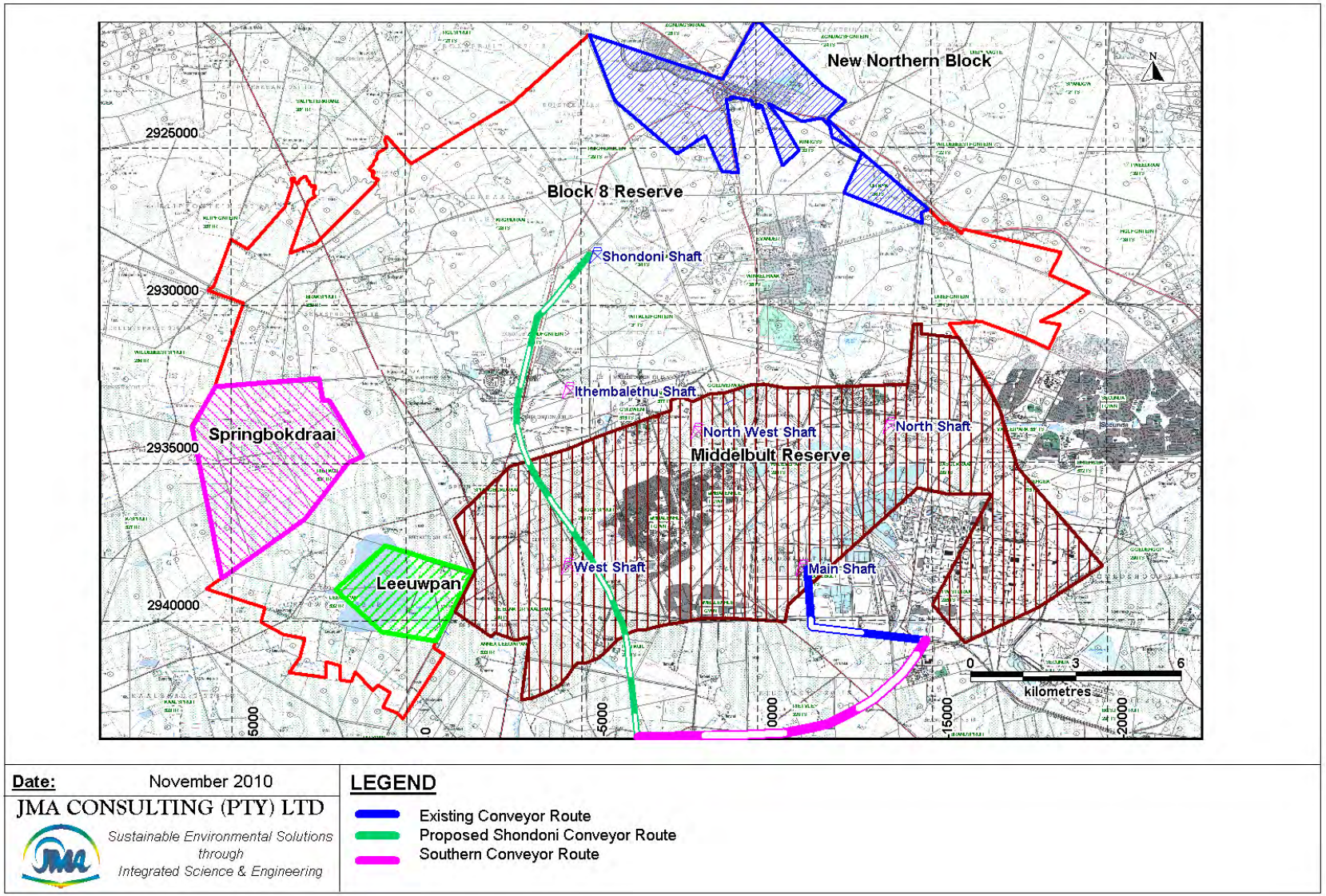


Figure 4.8.4.1 (a): The existing Middelbult-Block 8 Surface Coal Conveyer from Main Shaft to SCS

4.8.7 Water Management Infrastructure

Sasol Mining performs water management on a mine by mine basis as far as practically possible. Each shaft therefore provides for its own water management infrastructure on surface, whilst underground mine water management is designed on a reserve and mine lease boundary scale.

The schematic layout shown in Figure 4.8.7(a) shows the generic water management setup for raw water (potable water), service water and storm water at each of the Middelbult Bock 8 surface shafts.

The water management infrastructure at the surface shafts generally provides for:

- Storage and distribution of potable water
- Storage and distribution of service water (used in underground for cooling and dust suppression)
- Capture and containment of affected storm water

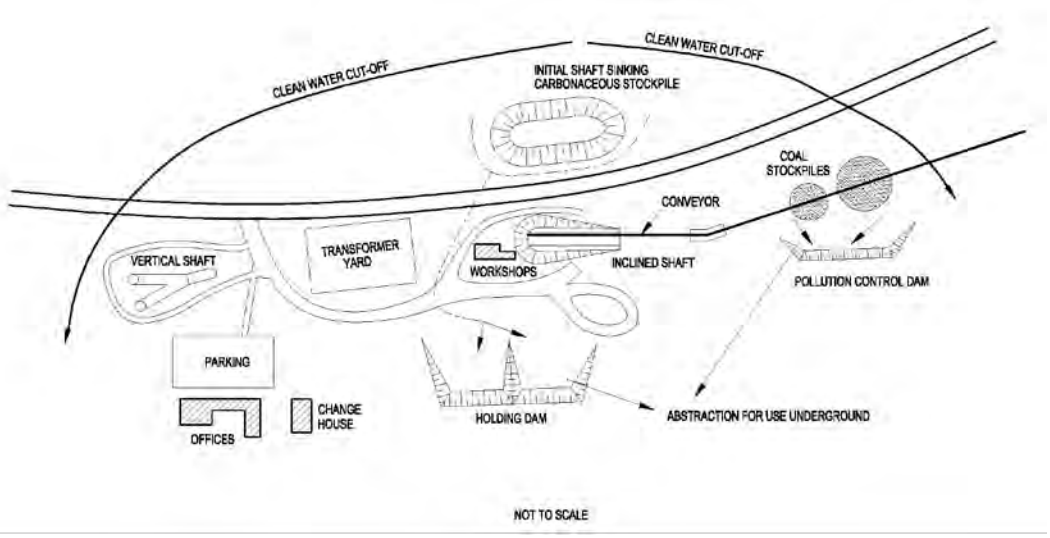


Figure 4.8.7(a): Schematic Shaft Water Management Layout

4.8.7.1 Raw/Potable Water Supply and Storage

All Middelbult-Block 8 shafts use Rand Water for potable and general domestic purposes. The water is received via pipeline and then stored in surface storage reservoirs and/or elevated header tanks for gravitational reticulation to the various end users on surface (offices, change houses, workshops) and underground.

Typical raw/potable water supply/storage infrastructure, in this case the system currently used at iThemba lethu Shaft, is shown in Figure 4.8.7.1(a)

Figure 4.8.7.1(a): Potable Water Storage at Shaft Complex

Water balance diagrams, indicating potable and service water use at the five existing shaft complexes, were re-compiled form the existing approved EMPR documents and are shown in Figure 4.8.7.1(b) through Figure 4.8.7.1(f).

4.8.7.2 Process/Service Water Supply and Storage

Mine water accumulating into the underground workings is recycled and used for mining purposes underground. The water is extracted from underground via a borehole and pumped into service water dams located on surface at the shaft complexes. This is done to generate a sufficient pressure head before the water is reticulated back into the mine workings under gravitation.

The service water dams on surface are specifically constructed facilities as they contain affected (dirty) water and are authorized in terms of a NWA section 21(g) water use. A typical service water dam system is shown in Figure 4.8.7.2(a).

Figure 4.8.7.2(a): Service/Process Water Storage at iThemba lethu Shaft

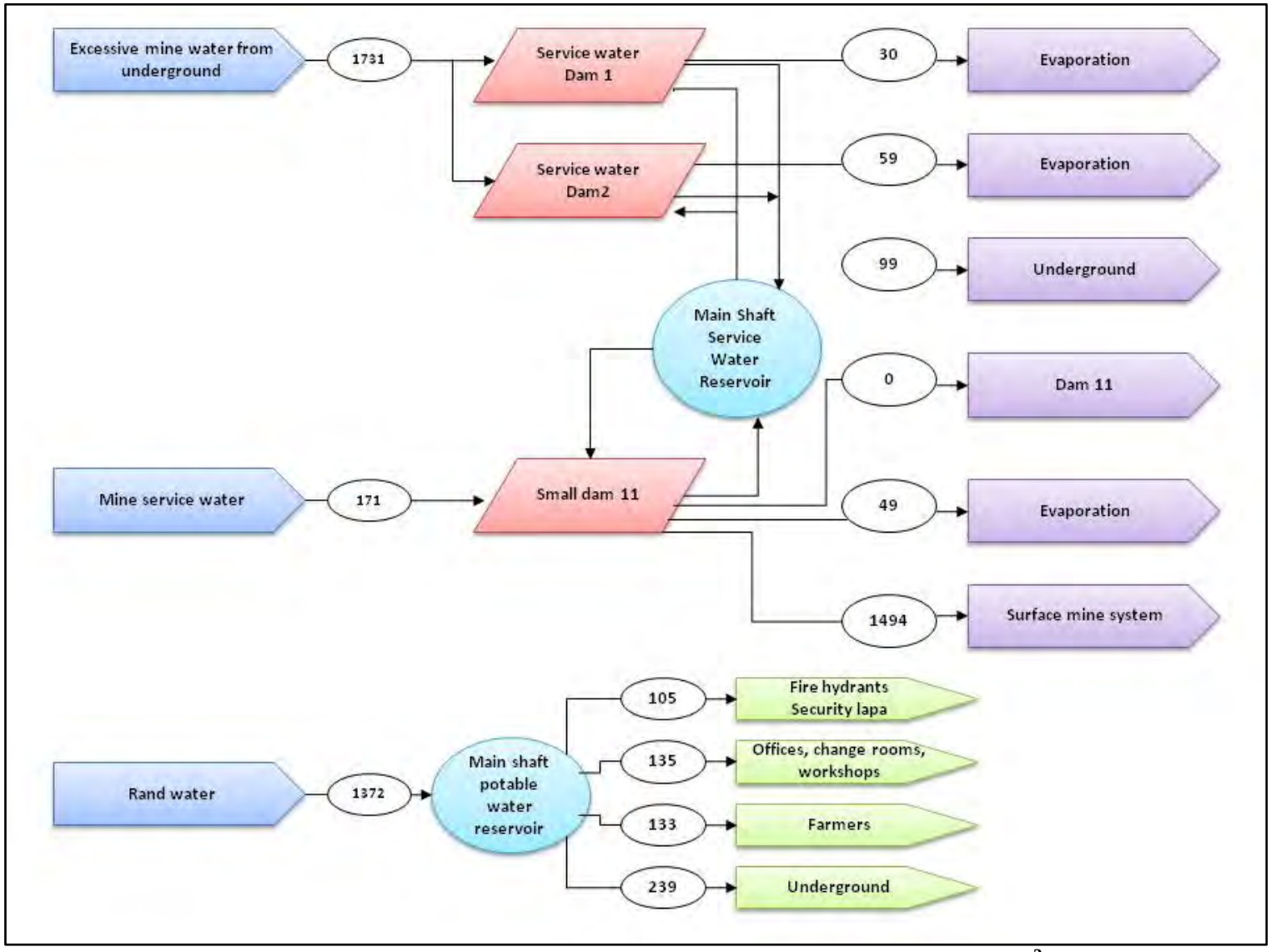


Figure 4.8.7.1 (b): Water Balance Diagram for Middelbult Main Shaft (volumes in m^3/day)

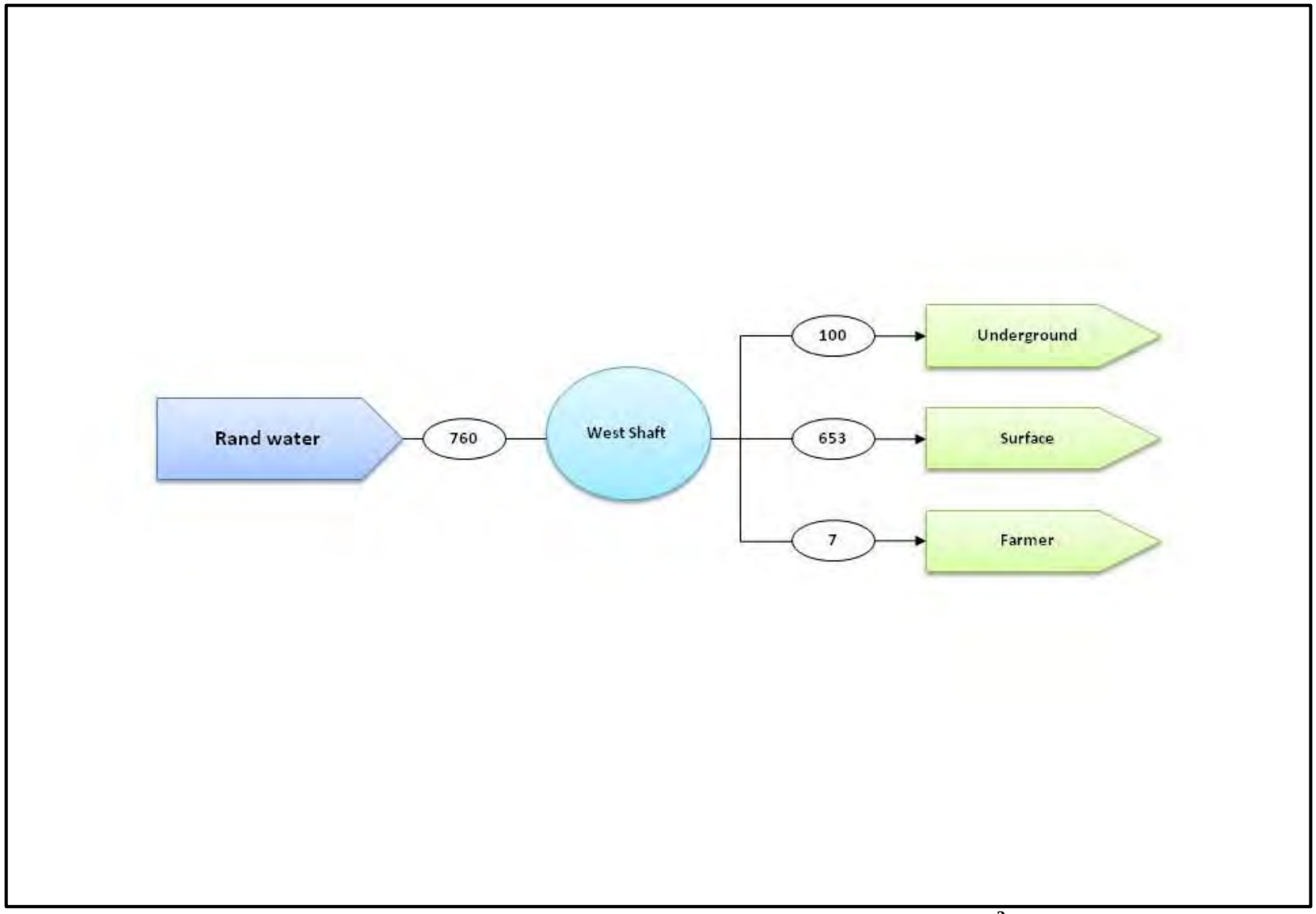


Figure 4.8.7.1 (c): Water Balance Diagram for Middelbult West Shaft (volumes in m^3/day)

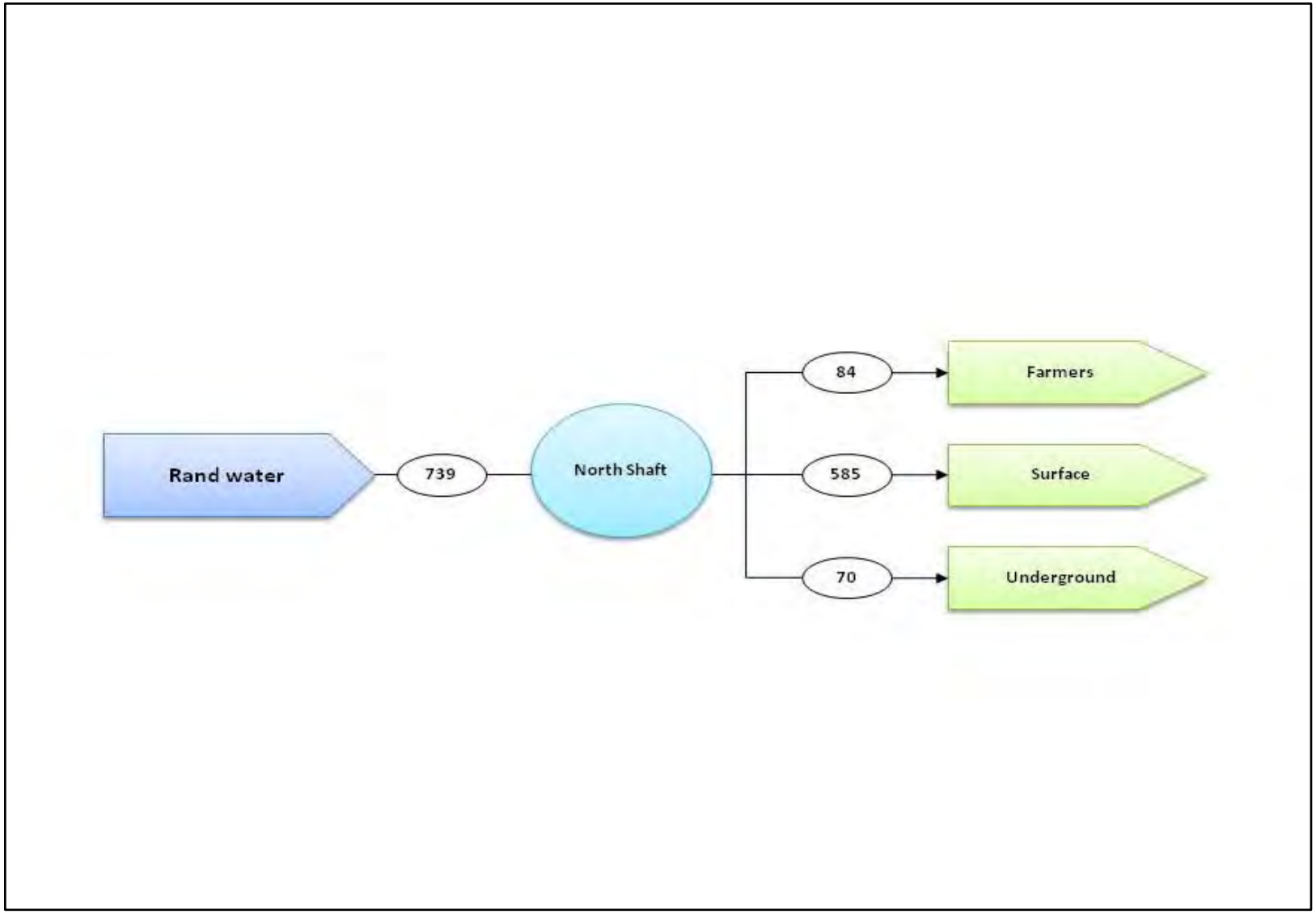


Figure 4.8.7.1 (d): Water Balance Diagram for Middelbult North Shaft (volumes in m^3/day)

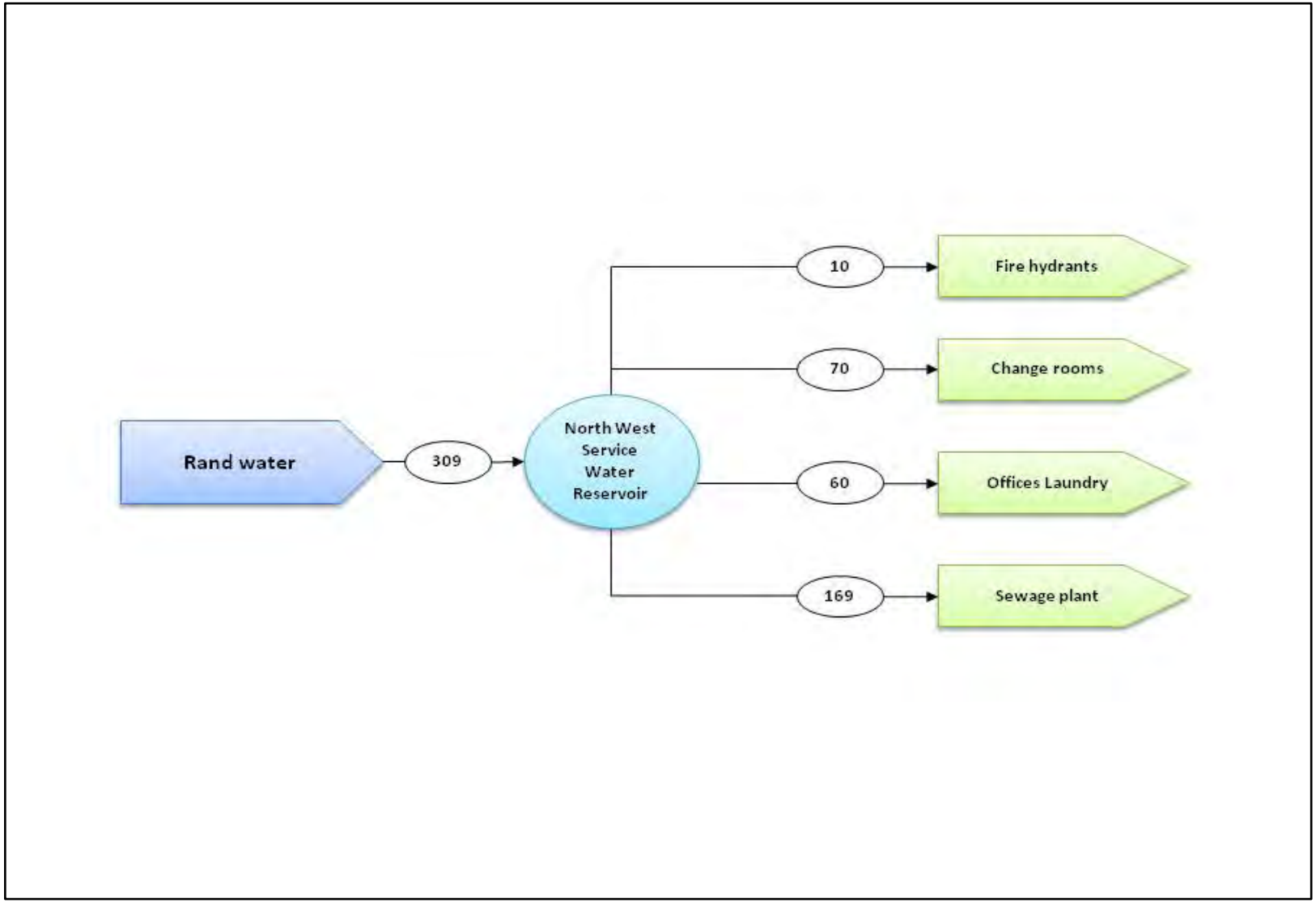


Figure 4.8.7.1 (e): Water Balance Diagram for Middelbult North-West Shaft (volumes in m^3/day)

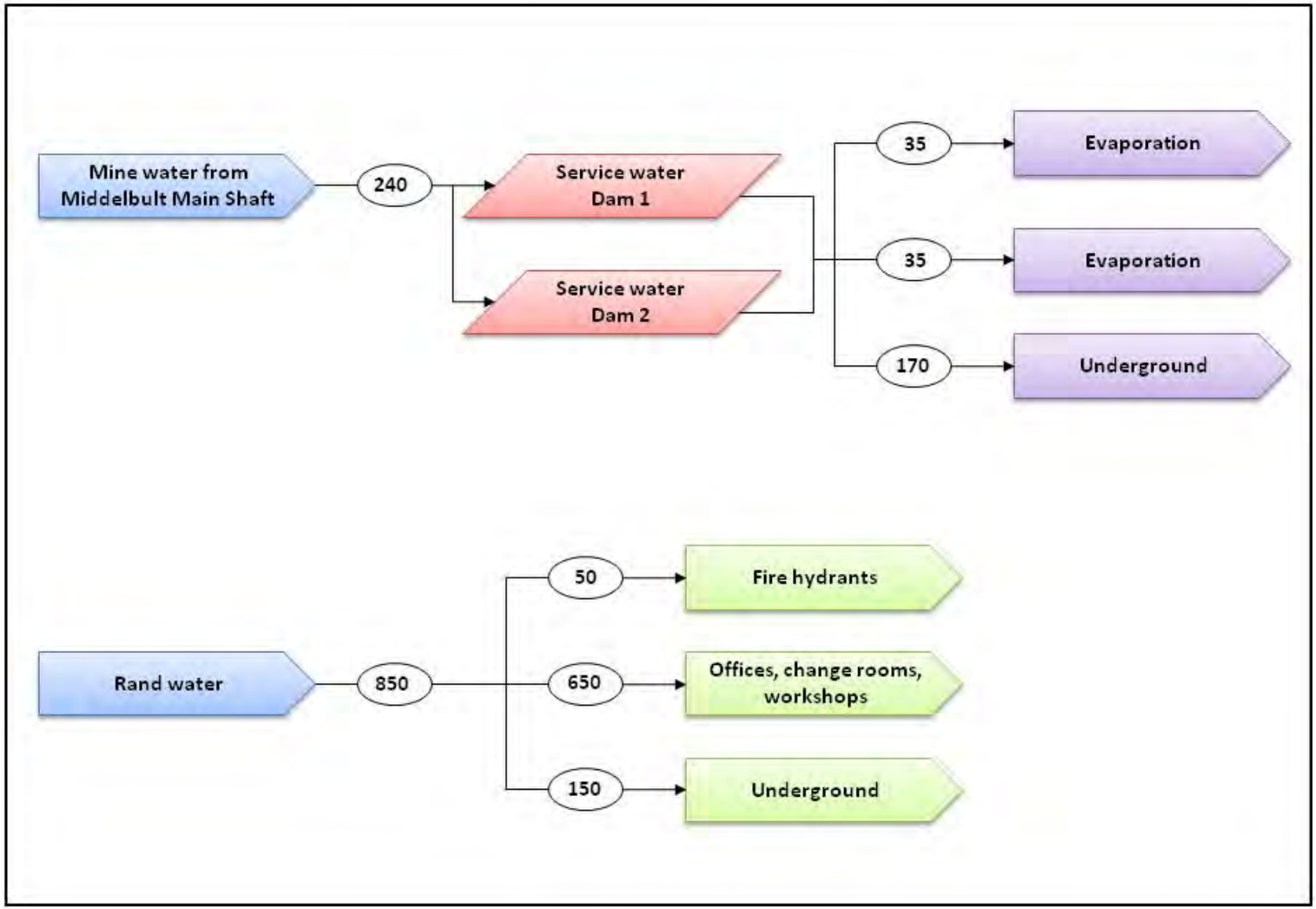


Figure 4.8.7.1 (f): Water Balance Diagram for Middelbult i Themba Lethu Shaft (volumes in m^3/day)

4.8.7.3 Storm Water Management System (bunds/berms/canals/PCD's)

Storm water management at the existing shaft complexes are done in accordance with the requirements as specified in regulation GN 704 of the NWA, which deals specifically with mine water management at mines. This involves the separation of clean and dirty water at the shafts with a series of berms, cut-off canals and bunds around dirty areas - see Figure 4.8.7(a). Clean water is diverted around and off the site whilst dirty water is captured and contained in Storm Water Pollution Control Dams and/or oil traps.

In terms of the requirements of GN 704 of the NWA, polluted storm water run-off must be contained in specially constructed Pollution Control Dams (PCD's) and may not be discharged into any water resource without DWA authorisation. The water in the PCD can be reused on the mine, or else must be treated to acceptable standards prior to its release back into the environment.

Similar to the service water dams, PCD's are also specifically constructed facilities as they contain affected (dirty) water and are also authorized in terms of a NWA section 21(g) water use. A typical PCD layout is shown in Figure 4.8.7.3(a).

Figure 4.8.7.3(a): Storm Water PCD at Shaft Complex

For the current Middelbult-Block 8 operations, PCD's (also called evaporation ponds) are present at Main Shaft, West Shaft and North West Shaft. At North Shaft and iThemba lethu Shaft) storm water pollution is restricted to possible contamination from paved areas and workshops. Here, oil traps are installed where required, and the surface water is either discharged or recycled after oil skimming has taken place. A typical oil skimming setup (iThemba lethu Shaft) is shown in Figure 4.8.7.3(b).

Figure 4.8.7.3(b): iThemba lethu Oil Trap and Skimmer System

4.8.7.4 Excess Mine Water Management

Excess mine water is defined as the water accumulating underground in the workings and which is not used as service water by the mine, or is lost through ventilation. Excess mine water is dealt with by means of a network of underground storage dams as well as surface located Pollution Control Dams for water which cannot be stored underground.

The extent of the underground storage of mine water, as well as the handling of excess mine water pumped to surface, will be dealt with in the Middelbult Integrated Mine Water Balance discussion in section 4.10 of this report.

The integrated, surface located, excess mine water management infrastructure, which deals collectively with the excess mine water generated by Brandspruit, Bosjesspruit, Middelbult and Twistdraai Collieries, is shown in Figure 4.8.7.4(a). More details on these facilities are given in the Integrated Water Management Plan (IWMP) for the Sasol Secunda Industrial and Mining Complex.

The responsibility for the effective operation, maintenance and legal authorization of the individual PCD's comprising the overall system, has been assigned to respective mining operations. Middelbult is responsible for the following PCD's forming part of the overall Integrated Mine Water Management System.

Facility Name	Capacity (m^3)
Service Water Dam West	26 400
Service Water Dam East	51 600
Small Dam 11	320 000

However, the excess mine water management system for Middelbult Colliery is not yet connected to the overall Sasol Mining Excess Mine Water Management System. The **broken blue line** in Figure 4.8.7.4(a) indicates that the pipe line to connect Midelbult Colliry to the overall system is still not in operation. The due date for commissioning of this pipe line is 2012.

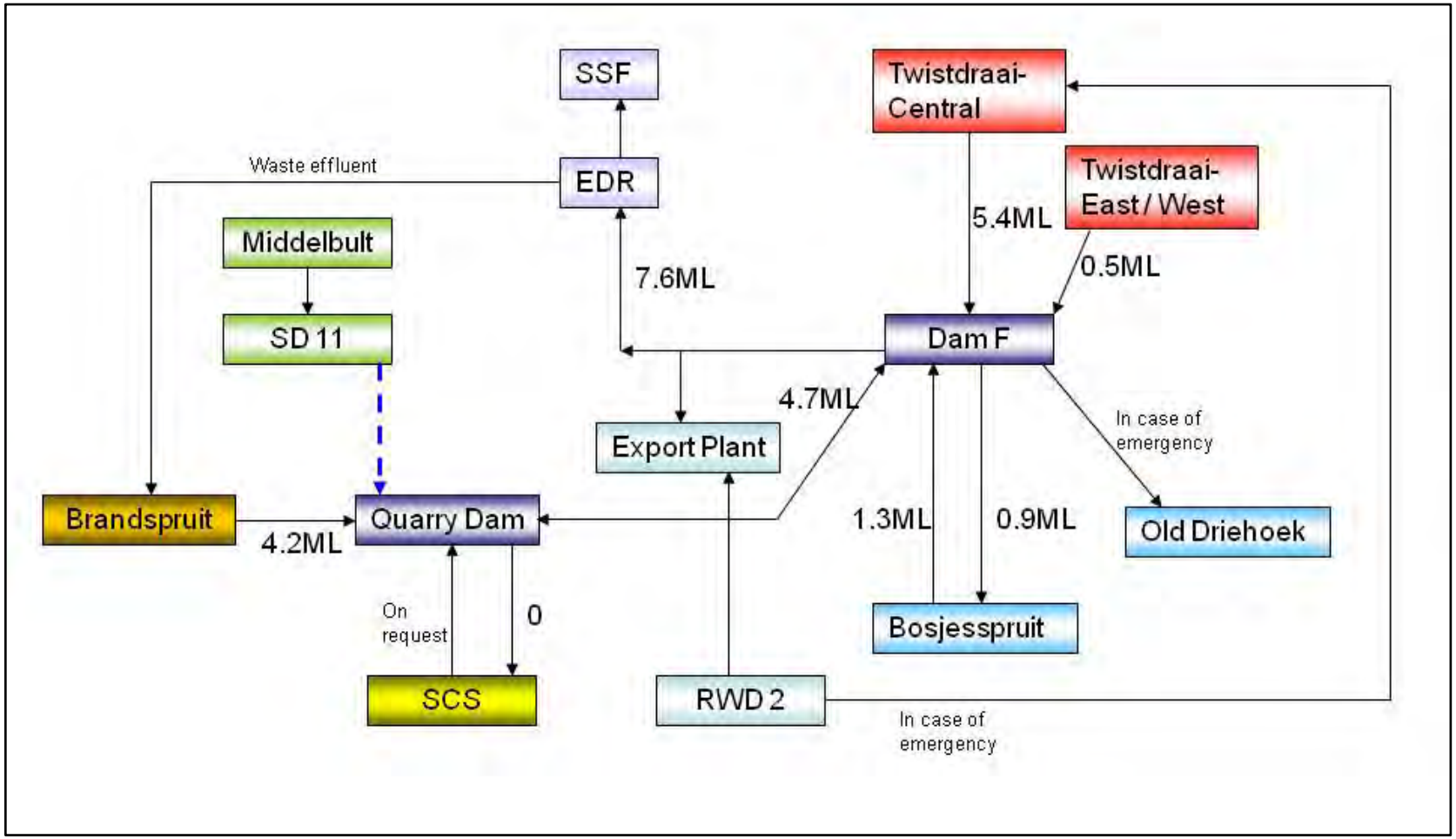


Figure 4.8.7.4 (a): Integrated Mine Water Management System Infrastructure for Secunda Collieries

4.8.7.5 Sewage Treatment Plants

All five the existing shafts at Middelbult-Block 8 generate sewerage. However, only 3 of the 5 shafts (West Shaft, North-West shaft and iThemba lethu Shaft) treat their own sewerage at the shaft complexes.

Sewerage from **Main Shaft**, as well as from **North Shaft** is collected in sumps of their respective sewage pumping stations and is pumped to the sewage treatment plant at Unit 52 of Synfuels. This plant has a capacity of 13 Ml/day and is designed for biological nutrient removal.

Sewerage from **West Shaft** is treated at a sewage treatment plant on site. The plant uses the activated sludge process and is designed to serve 815 people per day (100 m^3/day Average Dry Weather Flow). After chlorination, the treated effluent is collected in a retention dam. The overflow from the retention dam flows directly into the Groot Spruit. Some of the treated water is used for garden irrigation at the shaft.

Sewerage from **North-West Shaft** is treated at a sewage treatment plant on site. The plant uses the activated sludge process and is designed to serve 225 people per day (25 m^3/day Average Dry Weather Flow). After chlorination, the treated effluent is collected in a retention dam. The overflow from the retention dam flows directly into the Winkelhaak Spruit.

Sewerage at iThemba lethu Shaft is treated at a sewage plant on site. The plant is a self-contained system, the maturation water discharge from which is managed to acceptable standards for discharge into the Groot Spruit. The sewage plant at iThemba lethu Shaft is shown in Figure 4.8.7.5(a).

Figure 4.8.7.5(a): Sewage Plant at iThemba lethu Shaft

4.8.7.6 Water Treatment Plant

Apart from the sewerage treatment, no other water treatment is done at Middelbult-Block 8.

4.8.8 Waste Management Facilities

4.8.8.1 Mine Residue Disposal

No mining wastes such as discard or coal fines slurry are generated at Middelbult-Block 8. The coal cut from the coal seams underground, is conveyed as ROM coal from the underground, via an incline shaft at Main Shaft, along the surface conveyor belt to the SCS central coal stockpile area. The overburden material excavated from the shaft during the shaft construction was used in small amounts for berm walls and embankments at the shaft complexs and was be covered with clay and topsoil before these structures were re-vegetated. The placement of these materials was dealt with in terms of a NWA section 21(g) water use authorisation.

4.8.8.2 Domestic/Small Industrial Waste Disposal

All household (general or domestic) and small volumes industrial wastes are separated and disposed of in bins within dedicated concrete lined and bunded structures for removal off-site by outside licensed waste management contractors.

Figure 4.8.8.2(a): Domestic/Industrial Waste Disposal Facilities (iThemba Lethu Shaft)

4.8.8.3 Hazardous Waste Disposal

The only hazardous wastes generated at the shaft complexes relate to oily rags, fluorescent tubes, etc. These wastes are also deposited in skips located in concrete lined and bunded areas, after which they are removed off site by waste management contractors.

4.8.8.4 Storage/Salvage Yard

Storage/salvage y ards for the int erim s torage of r eclaimed non-hazardous materials, exist a t the Middelbult-Block 8 s haft complexes. Figure 4. 8.8.4(a) below shows the Salvage Yard at iThemba lethu Shaft.

Figure 4.8.8.4(a): Typical Salvage Yard

4.8.9 Proposed Shondoni Shaft Infrastructure

The surface infrastructure associated with the proposed new Shondoni Shaft Complex is currently in the planning/design stage. Although small variations to fit in with site specific conditions will occur, the shaft complex will closely resemble the Thubelisha Shaft Complex. The layout shown in Figure 4.8.9(a) below, represents the surface infrastructure layout designed for the Shondoni Shaft.

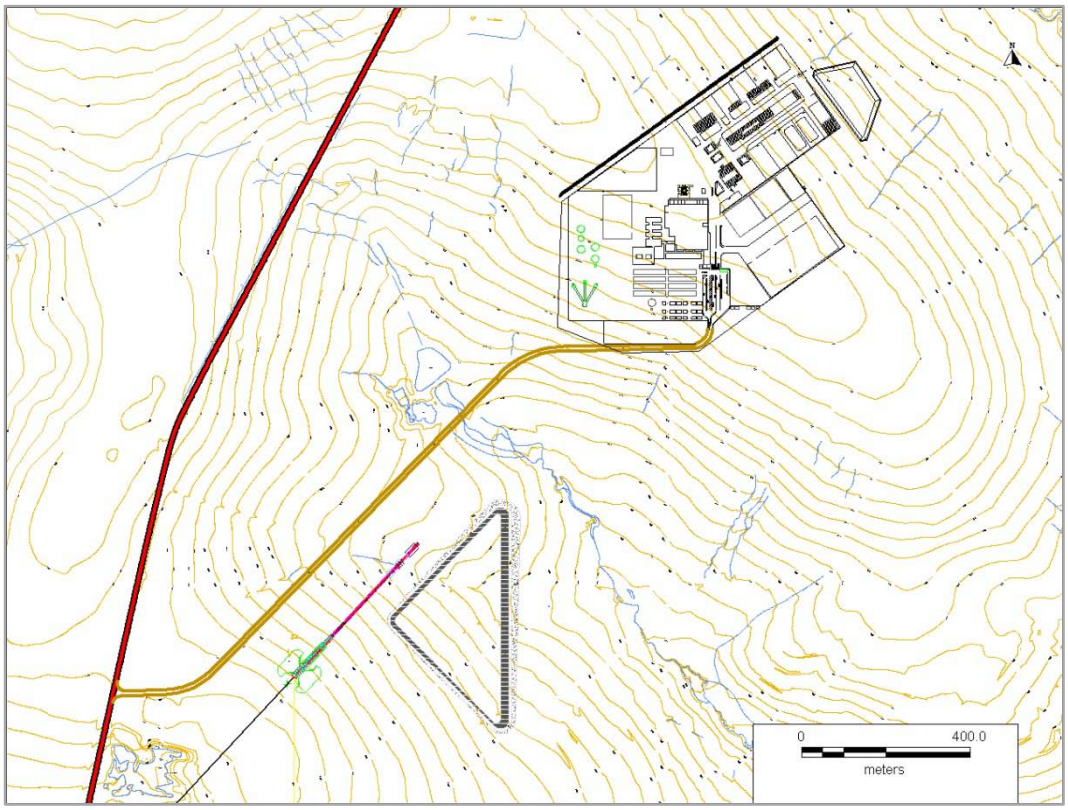


Figure 4.8.2(a): Surface Layout for the Shondoni Shaft Complex

4.8.9.1 Shondoni Shaft Surface Infrastructure

The Shondoni Shaft Complex will be located within a fenced secondary security area. The Shaft Complex will be accessed along a newly constructed tar road with a T-junction from the provincial secondary road R547. The Shaft Complex itself will contain the following infrastructure:

- People and Material Shaft
- Ventilation Shaft
- Decline Shaft - the Shaft Portal will be covered by an enclosed steel structure
- Surface Bunker
- ROM Emergency Stockpile
- Shaft and Workshop Area (dirty area)
- Procurement and Supply Management Store
- Diesel Workshop and Lubrication Bay
- Telemetric Workshop
- Surface Services Workshop
- 11kV Workshop
- Underground Services Workshop

- Production Workshop
- Offices and Change House Area (clean area)
- Change House building
- Office block including management, administrative and technical offices
- Security building
- Services Area (clean area)
- Pump Houses for Potable Water
- The Temporary Construction Area (clean and dirty area)
- Construction Management Site Offices
- Medical and Induction Centre building
- Substation Buildings
  - Main Shaft
  - Ventilation Shaft
  - Incline Shaft and Surface Bunker area
  - Two substation buildings on Overland Conveyor
- Internal Roads and Parking Areas
- Fuels Storage
- Soils/Overburden Stockpiles
- Raw/Potable Water Supply and Storage
- Process Water Supply and Service Water Storage Dams (PCD)
- Storm Water Management System (bunds/berms/canals)
- Pollution Control Dam
- Sewage Treatment Plant
- Domestic Waste Disposal Facilities
- Industrial/Hazardous Waste Disposal Facilities
- Salvage Yard

4.8.9.1.1 Access Road

A tarred access road of approximately 1800 m will be constructed from the R547 Kinross-Balfour road to the Shondoni Shaft Complex.

The take-off position has been chosen as the R547 at this point is relatively flat with good vision for traffic in both directions. It is some 500m to the south of a shallow curve in the road. The curve is positioned on a slight rise with somewhat restricted traffic views.

Figure 4.8.9.1.1(a) shows a photo collage of the construction activities and the final road for a similar road to the one to be constructed at Shondoni.

Figure 4.8.9.1.1(a): Typical Access Road to be constructed for Shondoni

4.8.9.1.2 Offices/Workshops/Wash Bays/Stores/Change houses

A modern building complex, comprising of offices, workshops with wash bays, stores and change houses will be built at Shondoni. The underground operation will comprise of nine mechanised sections and two stone work sections, for which support facilities will be located on surface. The photograph depicted in Figure 4.8.1.2.2(a) shows a similar surface infrastructure as that proposed for Shondoni.

Figure 4.8.1.2.2(a): Similar Building Complex as proposed for Shondoni

The guidelines of the Green Building Council of South Africa have been taken into account during the design. For the conceptual design only some of these guidelines have been incorporated such as building orientation, optimization of natural ventilation and optimization of natural light. However, value engineering will be done during the next phase and typical actions may include reduction of energy usage by means of double glazing, insulation, use of solar energy, reduction of office volumes, thermostat controls and movement sensors for lighting. Input from production and administrative personnel have been taken into account for optimization.

Buildings will comply with SANS 10400 – The Application of the National Building Regulations. The Change House building will be within 20 m distance from the Man and Material Shaft. The Design Parameters for the determination of building sizes has been based on the Sasol Mining norm of working two mining shifts per day with the third shift utilized for maintenance, during a normal five day week. One, and at times two shifts, are worked on a Saturday with Sunday being an off day. This equates to 492 coal shifts per annum.

Shondoni Mining Personnel compliment will be 600 per shift, giving 1 200 per day for shower facilities. This will be complimented by 400 miners (200 per shift) via the iThemba lethu Shaft. These miners will generally continue to utilize the shower facilities at iThemba lethu. For the mid-term mining program, administration and maintenance personnel for Shondoni will be located at the Shondoni Mine Infrastructure site and will cater for 200 people. Thus:

Shondoni Underground personnel per shift per day: 600 x 2	=	1 200
iThemba lethu Underground personnel per shift per day: 200 x 2	=	400
Administrative and Maintenance personnel per day:	=	200
Total allocation to Shondoni Mine		1 800

The Change House building is sized according the abovementioned number of employees.The building consists of 22 modules catering for 108 people each. Conversion from men's to ladies' facilities is easy to achieve with the modular approach. Modules can therefore be converted to adapt to the gender distribution at any specific time. The building also makes provision for facilities such as:

- Laundry Room
- Auditorium
- Boiler Room
- Pro-shop
- Lamp Room
- Offices for Union Representatives
- Communication Centre Production and Communication Centre
- Control Rooms
- Canteen
- First Aid Room
- Facilities for the Proto Teams

Workshops sizes were designed to cater for 8 Continuous Miner sections and 2 Stonework sections. Input and requirements from production personnel were also taken into account and items such as gantries and crane rails were added where required.

The size of the Procurement Main Store was based on a similar building at another Shaft and is located close to the main security gate for practical purposes. The size and layout of the Main Security Building is in principle the same as for other similar shafts.

The sizes of all other buildings were determined by the requirements of mechanical and/or electrical equipment.

4.8.9.1.3 Internal Roads and Parking Areas

Internal roads and parking areas will be fully paved. Other open areas will be grassed with kikuyu lawns. The photograph depicted in Figure 4.8.1.2.3(a) shows the extent and type of paving to be used.

Figure 4.8.1.2.3(a): Paving to be used for Shondoni Internal Roads and Parking Areas

4.8.9.1.4 Electricity Supply and Substations

SASOL Mining has made application to ESKOM for a new point of supply for Shondoni Mine. A further option from ESKOM for consideration by Sasol Mining is to supply power from the existing iThemba lethu shaft, 88kV point of supply from a very old and aging distribution network or cut into the existing distribution from SOL to iThemba lethu.

At present it is foreseen that point of supply will be via a 132kV line from SOL B which will be located at ESKOM Capital general area. Medium voltage supply will be from the Shondoni Mine 11kV Main substation and will supply the surface infrastructure, underground mining infrastructure, production sections and stone work sections.

A typical electrical sub-station, similar to the one required at Shondoni, is shown in Figure 4.8.9.1.4(a). Power lines will also be constructed.

Figure 4.8.9.1.4(a): Electrical Sub-Station required at Shondoni

The surface 11kV distribution will include the following:

- Bunker Reclaim conveyor
- Bunker
- Tripper Conveyors
- Incline Conveyors
- Bypass Conveyor
- Ventilation Shaft
- People and Material Shaft
- Total Shondoni Mine Site Complex

Power for the conveyor drives overland Conveyor 1 and overland Conveyor 2 will be via 11kV overhead line rated 10 MVA from the existing Middelbult Central Mine 11kV main substation and supplied from the conveyor system substations 1 and 2. The overhead line will be constructed and installed in the existing and future conveyor servitudes.

The bunker reclaim conveyor will be supplied with power from the Shondoni Mine 11kV main substation via the surface infrastructure reticulation. The VSD drive for the bunker reclaim conveyor will be rated at 260kW and supplied power at 400 volt. The number of motor drives for the overland conveyors was reduced and rated at 1000 kW with a supply voltage of 690 volt.

Underground mining distribution point of supply will be from Shondoni 11kV main surface substation via separate ring feeds to the 4C seam 11kV U/G main substation and 2C seam 11kV U/G main substation.

The point of supply for construction will be from the existing iThemba lethu Shaft 11kV Main substation via an OHL and will have a capacity rated for 10MVA. The outdoor construction substation will consist of substation structures such as busbars, transformer feeders, substation terrace, earthing and civils. Substation equipment will include, gang operated links, surge arrestors, pole mounted breakers, transformers, auxiliaries, supply/control cables MV and LV, electrical fence, alarm system and yard lighting.

Full compliance with Sasol Mining"s energy efficiency strategy will be required and which has been standardized on for the Sasol Mining complex.

An additional requirement for energy efficiency for ESKOM new points of supply, which must include certification for compliance by a registered Pr Eng registered with ECSA or a Certified Energy Manager accredited by the South African Association for Energy Efficiency.

4.8.9.1.5 Fuels Storage

Fuel storage on surface at Shondoni will be restricted to one 50 000 l diesel tank and 3 * 14 000 l oil tanks – total of 92 000 l. The tanks will be located on concrete a floor and within a bunded area.

4.8.9.1.6 Soils/Overburden Stockpiles

Soils removed during the topsoil stripping prior to construction will be stock piled, whilst rock overburden material removed during shaft sinking will be used to construct perimeter berms in the shaft area and storm water flow management berms. Once the berms are constructed the stock piled soils will be used to cover all berms and leveled areas prior to re-vegetation.

4.8.9.1.7 Housing

No housing will be provided as part of the Middelbult–Shondoni mining operations, neither for the existing, nor for the future operations. All employees will live in private dwellings within the greater Secunda – Trichardt – Evander – eMbalenhle area.

4.8.9.1.8 Recreational Facilities

Middelbult–Shondoni will not provide any mine based recreational facilities. Sufficient private and municipal recreational facilities are available in the greater Secunda – Trichardt – Evander – eMbalenhle area.

4.8.9.2 Mining Infrastructure

4.8.9.2.1 People and Material Shaft

The People and Material service shaft will be equipped with a 65 t capacity headgear mounted winder and single deck cage suitable for transporting 200 people based on 0.21 sq.m per person and floor area of 9.75 m x 4.52 m, as well as being suitable for accommodating a fully assembled 20 t shuttle car. The 65 t payload allows for a 12HM31 model CM (cutter head and tail conveyor removed) to be transported underground.

An 11.7 m diameter vertical service shaft will provide personnel and equipment access to the planned underground workings, utilizing a six rope shaft-top Koepe winder with counter weight, a 9.7 m x 4.5 m single deck cage (200 persons) and a 12 man service elevator with a counter weight.

Other than people, equipment and material no other services will utilize the shaft.

The shaft is to be fully lined, equipped with buntons and guides with a 15 m overrun at the shaft bottom. A water ring will be installed in the shaft to direct water seepage to the sump at the bottom of the shaft.

Figure 4.8.9.2.1(a): Typical Vertical People and Material Shaft

4.8.9.2.2 Shondoni Ventilation Shaft

Ventilation shafts are required to ventilate the underground mine workings. The shafts are usually constructed through raise boring from underground and the surface infrastructure comprises shafts exits together with extraction infrastructure.

For Shondoni, a 9.0 m diameter ventilation up-cast shaft fitted with three (3) main fans installed on surface at the main shaft complex, will be provided. Three main fans will be installed in a tri-furcation arrangement. The shaft is to be fully lined and equipped with a water ring and the station wing cuts developed to ensure the smooth flow of air from the workings of the mine at the No. 2 Seam Level.

A temporary station will be cut at No.4 Seam Level for the development phase which shall be closed off at production stage. Typical ventilation shaft surface infrastructure is shown on the photograph in Figure 4.8.9.2.2(a).

Figure 4.8.9.2.2(a): Typical Ventilation Shaft Surface Infrastructure

4.8.9.2.3 Decline Shaft

A 7.0 m wide x 3.5 m high, decline shaft, at an inclination of 12º will house two off 1500 mm conveyors, running parallel to each other to serve as the primary materials handling connection from the underground bunker to the surface, and also as a second intake airway. The decline shaft will be serviced by a walkway for belt maintenance.

Apart for a 50 mm water column for fire fighting and dust suppression and a lighting cable, no other services will be provided in the decline. The decline will also serve as a secondary personnel escape way.

4.8.9.2.4 Underground Mining Equipment

Underground coal mining at Shondoni will be conducted with continuous miners (CMs) in nine mechanised sections. Coal is cut with the continuous miners and loaded onto the shuttle cars to transport it from the working faces. Roof support is also installed on a continuous basis to stabilize the roof against collapse. The photo collage shown in Figure 4.8.9.2.4(a), depicts a continuous miner, a shuttle car and the roof support equipment.

Figure 4.8.9.2.4(a): Typical Underground Mining Equipment

4.8.9.2.5 Underground Mining Method

The primary mining method will be bord and pillar mining. High extraction is performed when portions of pillars are removed upon retreat out of a particular section. High extraction could lead to roof collapse which could in turn cause surface subsidence.

The diagram shown in Figure 4.8.9.2.5(a) represents a cross section through the underground workings indicating vertical and incline people and material shafts, vertical ventilation shafts, as well as the two Coal Seams to be mined. The ventilation air flow through the workings is illustrated by the blue and red arrows.

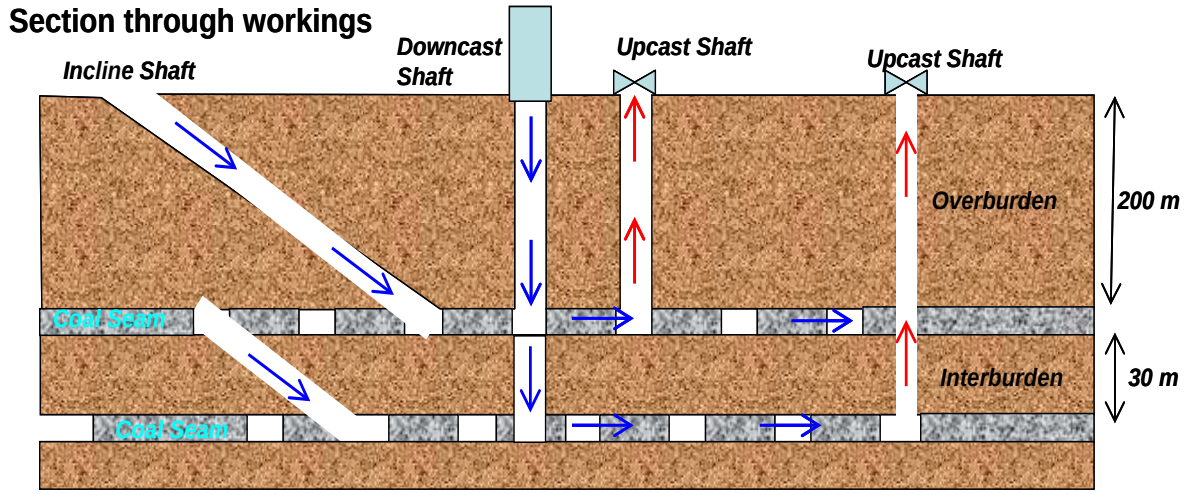


Figure 4.8.9.2.5(a): Cross Section through Underground Workings

The diagram shown in Figure 4.8.9.2.5(b) represents a planned view of the underground workings, portraying the roads, pillars and working faces. The utilization of stone work to manipulate air flow is also shown. Of further and particular significance is to observe the large mass of coal not extracted during bord and pillar mining, which also illustrates the requirement for high extraction to optimize extraction of the coal seams.

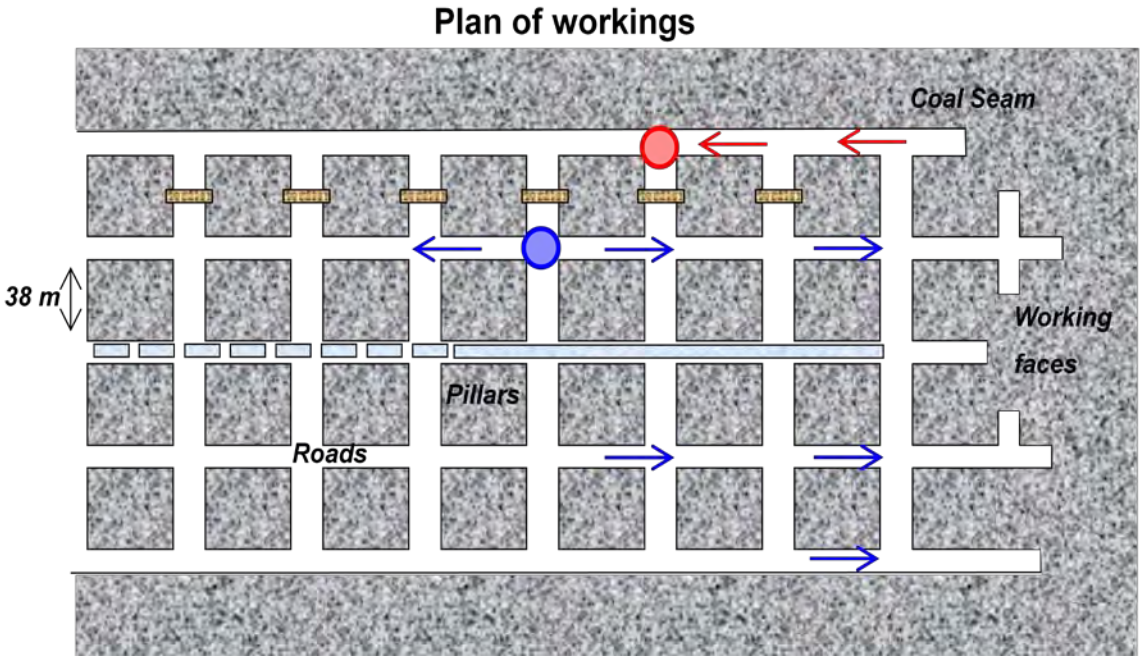


Figure 4.8.9.2.5(b): Plan View of Underground Workings

4.8.9.2.6 Underground Sequential Mining Plan

The underground mining plan shown in Figure 4.8.9.2.6(a) is the proposed mine plan and mining schedule for the No.C4L coal seam in the Block 8, Leeuwpan and Springbokdraai reserves.

This mine plan has been optimized during a series of planning meetings during which aspects related to *inter alia* coal seam extraction, water make, subsidence and ground water recharge were considered and optimized. The selection of high extraction areas was further done subject to rock mechanical considerations and was selected and designed not to cause any surface subsidence or instability in the sub-surface.

A similar exercise was undertaken for the No. C2 Coal Seam. The proposed mine plan for the No. C2 seam is shown on Figure 4.8.9.2.6(b).

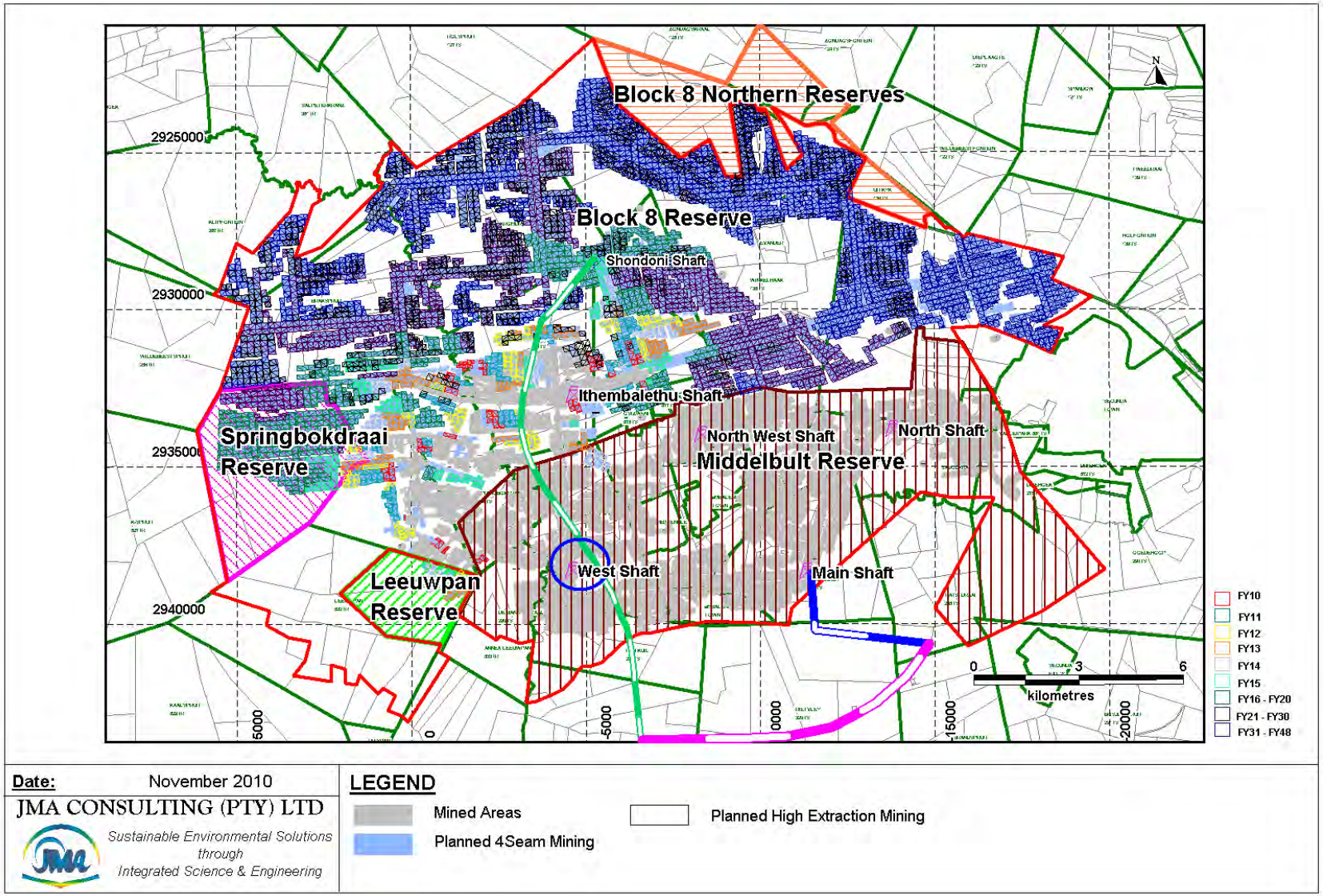


Figure 4.8.9.2.6(a): Proposed Mine Plan and Mining Schedule for the No.C4L Coal Seam

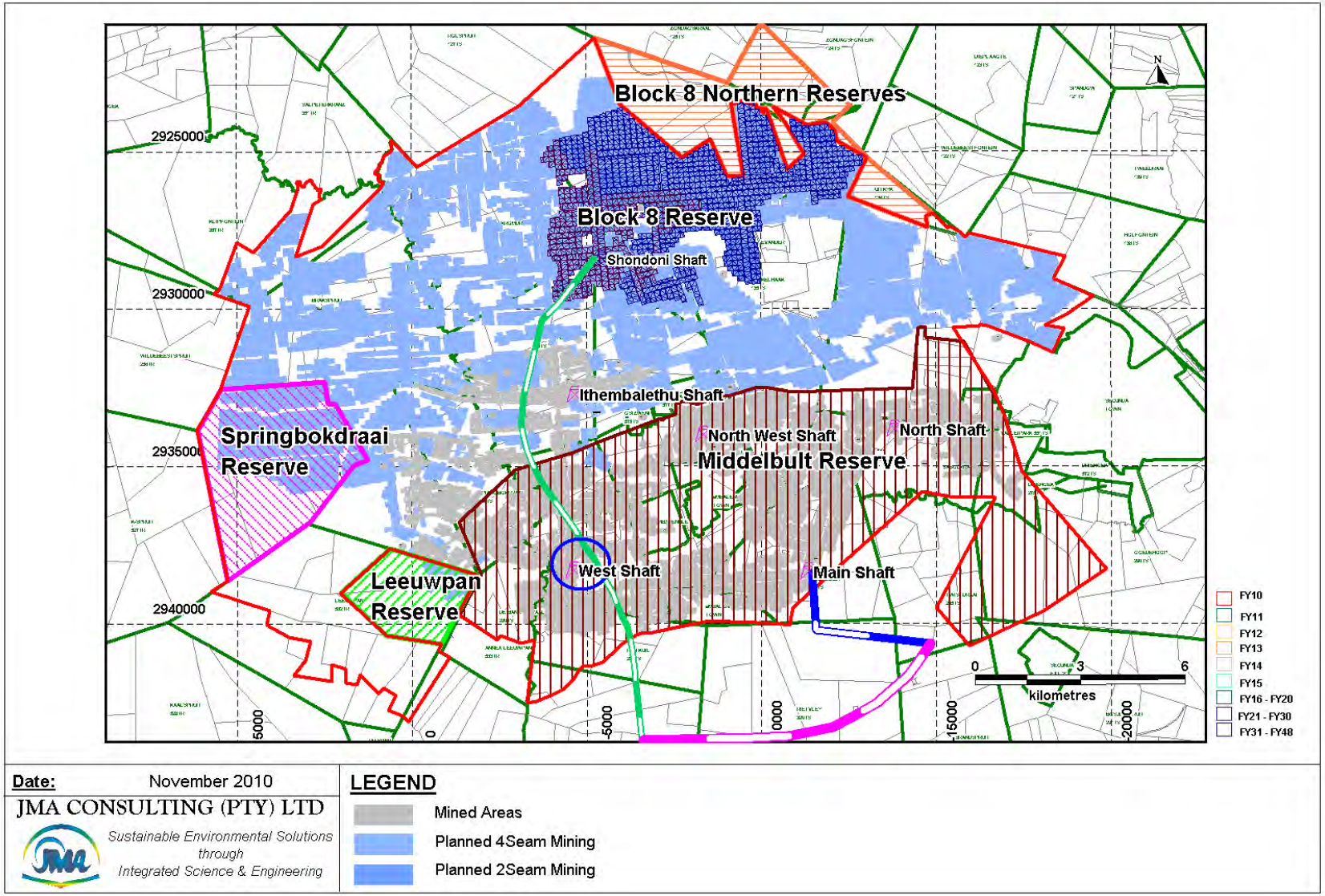


Figure 4.8.9.2.6(b): Proposed Mine Plan and Mining Schedule for the No.C2 Coal Seam

4.8.9.3 Coal Handling and Storage

Coal mined at Shondoni Mine shall be transported from the underground works to the shaft head surface surge bunker and thereafter, overland for a distance of approximately 15 km to link up with the Brandspruit Conveyor.

This section of the report describes the materials handling system at Shondoni, from the mobile boot end of the Trunk Conveyors in Seams C2 and C4L, through to the Surge Bin at the head of the Overland Conveyor system.

Coal will be mined from the each of the two (2) seams by Continuous Miners, which will deliver coal into shuttle cars, then to feeder breakers and through a crusher, which sizes the coal to -150 mm lump size. The coal is loaded at 800 t/h from the crushers onto Section Conveyors, which will be units that can be moved and extended around the mine to suit the coal face and Trunk Conveyor locations.

Seam C2 will have a total of three (3) Section Conveyors loading onto two (2) Trunk conveyors, while Seam C 4L will have a total of five (5) Sections Conveyors and three (3) Trunk Conveyors. The balance of coal delivery in the early years will be mined by production units from the iThemba lethu Shaft.

4.8.9.3.1 Trunk Conveyors

Each Trunk Conveyor has been designed for the total flow of coal from the Section Conveyors feeding onto it, with additional volumetric capacity for surge loads up to 3,600 t/h. In Seam C2, two (2) Trunk Conveyors will receive coal from a total of three (3) Section Conveyors, and feed into a new equalizing underground bunker of 500 t live capacity. Two (2) luffing chutes will be positioned at the bunker outlet to feed onto a Interseam Conveyor.

Seam C4L will have three (3) Trunk Conveyors, receiving coal from a total of five (5) Section Conveyors, plus the iThemba lethu Shaft production. The iThemba lethu coal feed will average 1,156 t/h over the shift and will be modulated within the feed control range of two (2) luffing chutes to minimize coal in the iThembalethu bunker. The C4L Trunk Conveyors will feed directly into the Main Underground Bunker at the same level as the Interseam Conveyor.

A dewatering tripper is positioned on each of the Trunk conveyors to ensure water is removed from the belt prior to entering the C2 and Main Underground Bunkers. A self cleaning magnet is positioned at the discharge point of the dewatering tripper to remove tramp metal from the coal stream.

Dust suppression sprays will be used at the transfer chutes, except where loading into bunkers.

4.8.9.3.2 C2 Bunker

The C2 Bunker is designed to equalize and combine the feed from the C2 Trunk Conveyors, and discharge to the Interseam Conveyor at 1,800 t/h. The Bunker will be of nominal 500t live capacity. Bin level detection (ultrasound) will be installed to provide feedback to plant operators on bin fill levels.

Luffing chutes will control the feed to the Interseam Conveyor, however they will not provide modulation of flow rate, instead providing on-off control. The bin will have nominal 50 tonnes (10%) remaining at zero capacity (empty) to protect the bin cone from impact / wear damage and to stabilize feed out onto the Interseam Conveyor. The lower cone / outlet and luffing chute will be designed for ease of inspection and replacement. The design will include means of isolating the loaded bin to permit outlet and chute inspection, maintenance or replacement.

4.8.9.3.3 Interseam Conveyor

The Interseam Conveyor is designed to convey 1,800 t/h which is the combined capacity of the C2 Trunk Conveyors, with additional volumetric capacity up to 3,600 t/h to allow for surge loads. Its purpose is to elevate the material to the top of the Main Underground Bunker at the same level as the C4L Seam Trunk Conveyors, nominally 27 m above the C2 Seam. Dust suppression sprays will be used at the transfer chutes.

4.8.9.3.4 Main Underground Bunker

The Main Underground Bunker receives material from both C4L Trunks and C2 Trunks (after the C2 Equalising Bunker) at the C4L Seam level. The bunker diameter will be restricted to 11.7 m for geotechnical reasons. This will give a live capacity of 2,000 t and a depth of approximately 30 m. The base of the bunker will be supported by steel columns, and will allow for access around the luffing chutes and for cleanup. Bin level detection (ultrasound) will be installed to provide feedback to plant operators on bin fill levels. Luffing chutes will control the feed to the Surface Incline Conveyor, however, they will not provide modulation of flow rate, instead providing on-off control. The bin will have nominally 200 t (10%) remaining at zero capacity (empty) to protect the bin cone from impact / wear damage and to stabilize feed out onto the Surface Incline Conveyor.

4.8.9.3.5 Incline Conveyor

A single Incline Conveyor is to be installed initially with a design rate of 2,000 t/h from the underground system to the surface, with an additional volumetric capacity up to 3,600 t/h to allow for surge loads. As mine production ramps up, and the capacity of the Incline Conveyor system is required to be increased, two options are possible.

A second Incline Conveyor can be installed of equal capacity (2,000 t/h), parallel to the first Incline Conveyor, or the single Incline conveyor can be upgraded to 3,200 t/h, including a third drive on the existing drive station. The belt type chosen for the initial stage would have adequate capacity for this increased capacity without the need to speed up the conveyor.

An incline angle of 12 degrees was selected over a 17 degrees in order to locate the portal clear of the seasonal water coarse approximately 550 m from the tail pulley.

The conveyor will feed through diverter chutes to either load onto the tripper conveyor, into the bypass bunker, or onto the Emergency Stockpile Conveyor. Dust suppression sprays will be used at the transfer chute.

4.8.9.3.6 Tripper Conveyor

A single Tripper Conveyor is proposed initially, with the option of a future parallel conveyor as per the Incline Conveyor discussed above. The Tripper Conveyor receives coal from the Incline Conveyor and discharges via a moving tripper to the Surface Bunker. The conveyor is designed for 2,000 t/h, with a peak volumetric capacity of 3,600 t/h to accommodate surge loads. Dust suppression sprays will be used at the tripper transfer chute, and all scrapings from the discharge pulley directed into the bunker.

4.8.9.3.7 Surface Storage Areas

Material from the Incline Conveyor can be diverted in three ways at the head chute. The flow paths are:-

- Tripper Conveyor, which feeds material into the Surface Bunker or Throw Out Stockpile.
- Emergency Conveyor, which feeds out to the Emergency Stockpile in the event that the overland conveyor system is not operational and if the 15,000 t Surface Bunker and 15,000 t Throw-Out Stockpile are full.
- Bypass Bin which allows for direct feed to the Reclaim Conveyor. This can only be used for short periods of time, due to the Incline Conveyor rate being higher than the Reclaim Conveyor rate. The Bypass Bin has a live capacity of nominally 1,100 t.

4.8.9.3.8 Surface Bunker

The Surface Bunker is the primary option for feeding the Overland Conveyor system, receiving material from the Tripper Conveyor at 2,000 t/h initially (3,200 t/h future) and discharging via luffing chutes at 2,000 t/h to the Reclaim Conveyor. It is a modular concrete construction with a live capacity of 15,000 t, made up of 13 individual compartments. An additional by-pass compartment is located at the end closest to the Incline Conveyor, and a Throw-Out Stockpile is located at the opposite end.

The Bunker supports the Tripper Conveyor and has access stairs located at both ends. The entire bunker will be covered to protect the material from rain. The Bunker will employ level detection devices to control tripper location and prevent over filling. To prevent feed control issues onto the Reclaim Conveyor, the Surface Bunker will retain a small residual volume of coal when empty.

4.8.9.3.9 Throw-Out Stockpile

The Throw Out Stockpile is located at the downstream end of the Surface Bunker, and is fed directly by the Tripper Conveyor in the event that the Surface Bunker is full. It has a segmented conical shape with retaining walls provided to prevent material forming around the access areas along the Surface Bunker discharge.

The stockpile is situated over the Reclaim conveyor and discharges through luffing chutes, similar to the adjacent Surface Bunker luffing chutes. It is designed to permit dozing / pushing out of the coal to reclaim available operating capacity and to permit recovery of "throw-out" coal by loader CAT966 operation at a rate of approximately 400 t/h.

4.8.9.3.10 Emergency Stockpile

The Emergency Stockpile is located near the tail end of the Reclaim Conveyor, and is fed by the Emergency Conveyor in the event that the Overland Conveyor system is not working and both the Surface Bunker and Throw Out facilities are full. Material is reclaimed by front end loader and fed onto the reclaim conveyor via a dedicated loading hopper or for feeding onto the Throw out stockpile by front end loader. The capacity of the Emergency Stockpile is 15,000 t.

A typical surface coal bunker and its associated surface throw out area and emergency stockpile is depicted in Figure 4.8.9.3.10(a).

Figure 4.8.9.3.10(a): Surface ROM Coal Bunker, Throw-out and Emergency Stockpile

4.8.9.3.11 Emergency Conveyor

The Emergency conveyor is designed to carry material from the Incline Conveyor at 2,000 t/h to the Emergency Stockpile, bypassing the Tripper Conveyor, Surface Bunker and Bypass Bin in the event that these items cannot be used. The conveyor is supported by a single trestle, cantilevered over the Emergency stockpile.

4.8.9.3.12 Reclaim Conveyor

The Reclaim Conveyor will receive coal from multiple luffing chutes positioned along the base of the Surface Bunker, and also from a separate loading station to receive coal from the emergency stockpile or bypass stockpile.
It will travel beneath the Surface Bunker for approximately 130 m and then underneath an access road bridge positioned near the stockpile retaining wall, before loading onto the Overland Conveyor. The conveyor rate is 2,000 t/h, with a volumetric capacity of 3,400 t/h for surge loads. Dust suppression sprays will be used at the transfer chute, and all scrapings from the discharge pulley directed onto the Overland Conveyor.

4.8.9.4 Coal/Water/Electricity Conveyance and Reticulation

4.8.9.4.1 Coal Overland Conveyor

The Overland Conveyor will receive material from the Reclaim Conveyor, and travel approximately 15 km before discharging onto an existing Overland Conveyor running to SCS.

The conveyor will incorporate horizontal curves to negotiate the terrain, residential areas and other buildings / structures. The detailed design of the conveyor including extended wing idlers, banking angle of idlers, and pitch of idlers in the horizontal curve areas will be carried out at the next phase to ensure proper tracking of the belt under all load conditions.

To prevent carry back spillage along the conveyor route, belt turnovers will be used, with one at the head end and one at the tail end. Belt turnovers ensure the dirty side of the belt is facing up for both top and bottom strands of the conveyor, such that residual material does not fall off the belt as it passes over idlers. Each belt turnover will be approximately 25 m in length, suitable for 1200 mm belt width.

The conveyor design rate is 2,000 t/h, with a volumetric capacity of 2,500 t/h for surge loads. This capacity is restricted at this stage by the rate of downstream conveying and stockyard equipment, however consideration should be paid to upgrading the capacity to allow for a higher annual throughput.

Dust suppression sprays will be used at the transfer chute, and all scrapings from the discharge pulley directed into the Surge Bin.

A Surge Bin is located at the discharge of the Overland Conveyor prior to feeding onto the existing SCS conveyor system. The bin will have a capacity of nominally 2,000 t to allow for clearing of the overland conveyor system. The bin will be of steel construction, lined at the discharge cone and other high wear areas as determined in detailed design. The presence of a surge bin with sufficient volume to permit emptying of the overland conveyors will add flexibility to undertake maintenance requiring movement of the conveyors during prolonged SCS outages.

The Bin will feed through luffing chutes, standardised with the Surface Bunker chutes. It will be designed to operate at near empty, with 10% left in the bottom of the bin to protect the cone from falling material. The presence of this surge bin provides operational and maintenance flexibility and contributes to capacity and achieving target annual capacity.

The overland conveyor will be located within a fenced servitude. The servitude is also used as far as possible for water reticulation (pipe lines) as well as for electricity distribution (over head power lines). The servitude has a service road within the security fence and access to within the servitude is restricted via dedicated access facilities. No access onto neighbouring properties along the conveyor servitude is allowed.

The conveyor system will be covered and cricital sections will be fitted with special low noise rollers to minimize noise. Access across and underneath the servitude will be provided to land owners. The access crossings are specifically designed according to the individual requirements of the relevant property owner.

The photograph depicted in Figure 4.8.9.4.1(a) depicts a typical overland coal conveyor with its associated infrastructure and servitude.

Figure 4.8.9.4.1(a): A Typical Overland Coal Conveyor

4.8.9.4.2 Servitudes/Pipe Lines/Power Lines

Servitudes are registered for all pipe lines, power lines and other infrastructure which cross or occur on non Sasol Mining property. Care is taken to optimize servitude usage through multi use.

4.8.9.5 Mineral Processing Plant

Coal will be stored and pre-processed at Sasol Coal Supply (SCS, the central coal stockpile area), within the Sasol Secunda Secondary Area. None of these activities fall within the Environmental Authorisation ambit of the Middelbult – Shondoni operations.

4.8.9.6 Water Management Infrastructure

Sasol Mining performs water management on a mine by mine basis as far as practically possible. Each shaft therefore provides for its own water management infrastructure on surface, whilst underground mine water management is designed on a reserve and mine lease boundary scale.

The schematic layout shown in Figure 4.8.9.6(a) shows the proposed Shondoni Shaft water management infrastructure.

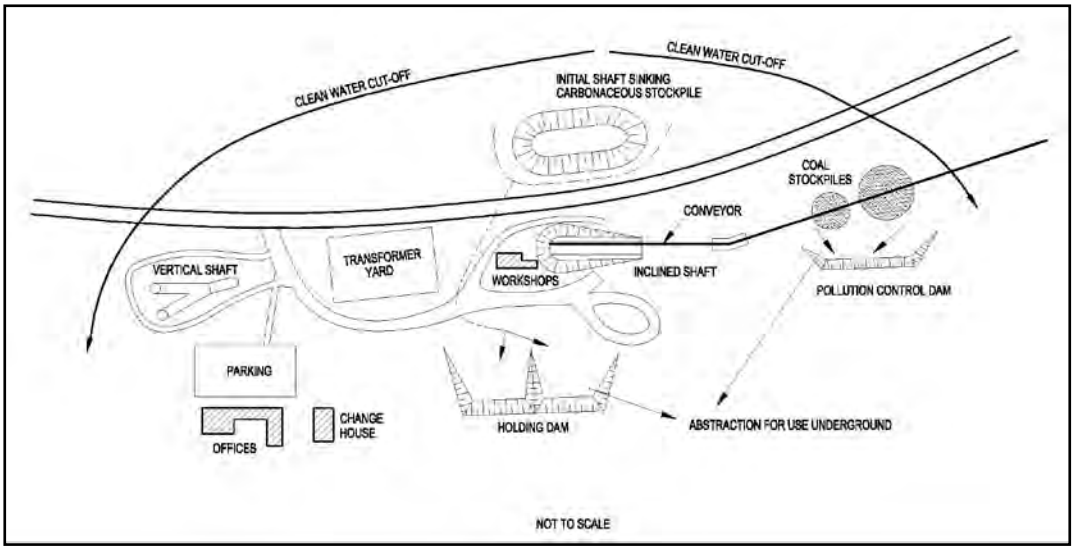


Figure 4.8.9.6(a): Schematic Shaft Water Management Layout

4.8.9.6.1 Potable Water Supply and Storage

Potable water will be required in two phases of the project, firstly Construction and secondly Operations, the latter commencing once the mine begins employment of site related personnel. It is anticipated that there will be some overlap of these two phases.

The potable water supply will be established to be ready for use prior to the first contractor's site establishment. The shaft sinking program calls for site establishment in April 2011. The first shaft to commence is the Decline Shaft followed shortly afterwards by the Vent Shaft. Prior to shaft sinking site establishment the main infrastructure earthworks and terracing, preparation of road access and site construction fencing will be need to be undertaken. Taking this into consideration it is estimated that effective earthworks site establishment should be as early as January 2011. Thus the potable water supply will need to be installed concurrently with the earthworks site establishment. These dates assume all legal aspects of establishing the Shondoni site will have been approved by this time.

The supplying of temporary potable water from iThemba lethu was deemed not practical due to the 6 km distance and possible way leave issues. In place of this it was suggested that a water borehole be drilled, closer to the Shondoni Mine but still within the confines of the Middelbult (iThembaletu) mining rights.

If this is possible, this drilling and subsequent borehole establishment – borehole casing, electricity supply, pump, water lines and head tank at Shondoni need to be procured from mid 2010 and implemented as soon as legal permitting has been approved.

The permanent potable water supply will be from the Rand Water Board supply main, some 5 km north of the Shondoni site. This will entail completion of the topographical survey to determine a water main route, applications to the Rand Water Board and / or the local Municipality for the connection to be made, issue an enquiry for the supply and installation of the 250 mm (assumed) diameter water main and placement of a contract. In view of these requirements commencement of this process also needs to be scheduled from start 2010 as part of the early works activities.

The "temporary" potable water supply to site will be via a Braithwaite type storage tank/reservoir with a capacity of 1.5 Ml. The water supply from the Braithwaite tank to the site construction facilities will be a pumped supply complete with pressure switch to ensure sufficient pressure is available in order to distribute potable water to the various site establishment offices, ablutions, showers as well as water for terracing bowsers and the water needs of the shaft sinking operations. Alternatively the pumps situated on the outlet of the Braithwaite Tank will supply water to an elevated head tank which in turn shall gravity feed water to consumers. During construction, fire hydrants and hose reels shall be made available being supplied from separate dedicated fire water pumps located at the Braithwaite potable water storage facility. After construction this facility shall become the permanent potable water reservoir.

During construction of the permanent potable water supply reticulation to the site infrastructure namely procurement store, offices, workshops etc. shall be installed. Potable water will be distributed to both C4L and C2 seam levels for drinking water.

The elevated header tank and associated surface buffer storage facility described above, will be similar to the ones shown in Figure 4.8.9.6.1(a) will be constructed at Shondoni.

Figure 4.8.9.6.1(a): Potable Water Storage at Shaft Complex

4.8.9.6.2 Process Water Supply and Storage

Mine water accumulating into the underground workings is recycled and used for mining purposes underground. The water is extracted from underground via a borehole and pumped into service water dams located on surface at the shaft complex. This will be done to generate a sufficient pressure head before the water is reticulated back into the mine workings under gravitation.

The service water dams on surface are specifically constructed facilities as they contain affected (dirty) water and are authorized in terms of a NWA section 21(g) water use. A typical service water dam system is shown in Figure 4.8.9.6.2(a).

Figure 4.8.9.6.2(a): Service/Process Water Storage at Shaft Complex

4.8.9.6.3 Storm Water Management System (bunds/berms/canals/outlets)

Storm water management at the shaft complex will be done in accordance with the requirements as specified in regulation GN 704 of the NWA, which deals specifically with mine water management at mines. This will involve the separation of clean and dirty water at the shaft with a series of berms, cut-off canals and bunds around dirty areas. Clean water will be diverted around and off the site whilst dirty water will be captured and contained in Storm Water Pollution Control Dams with silt traps.

The topography of the site is such that there is a natural slope on either side of a hill. The People and Materials Shaft will be located on the brow of the hill. After earth works, terracing and paving these natural slopes will have been retained. Full use is made of the natural topography such that the clean buildings being the main entrance, general offices, management offices and parking are all located on the south east slope. Thus the Storm Water falling on this slope will always be clean and as such can be discharged to the existing stream located south of this slope.

Situated on the north east slope are the potentially dirty buildings, being the Diesel Workshop, oil stores and other buildings, all with the possibility to contaminate Storm Water. This entire area will be curbed and where necessary bunded, to channel all Storm Water into the Shondoni Surface Pollution Control Dam.

The incline shaft, coal bunker and emergency coal storage areas will be located on the southern banks of a watercourse, which runs between the main shaft infrastructure and the exit of the incline shaft. Clean runoff from upslope areas will be diverted around the dirty areas by means of a system of berms and canals. Dirty runoff from these areas will be collected in stormwater canals and will pass through a silt trap into the ROM Tip Pollution Control Dam (PCD).

Along the conveyor route there is the potential for coal spillage at the transfer stations. Small PCD's are proposed for these areas.

Areas such as the parking areas, office areas and other related infrastructure that represents a low to negligible risk to the environment in terms of surface water will have runoff drained back to the clean catchment via a small sampling dam. This dam serves both to allow sampling of the quality of runoff, as well as the opportunity for a preventative skimmer in the event of any unexpected spillages.

4.8.9.6.4 Pollution Control Dams

In terms of the requirements of GN 704 of the NWA, polluted storm water run-off must be contained in specially constructed Pollution Control Dams (PCD's) and may not be discharged into any water resource without DWA authorisation. The water in the PCD's can be reused on the mine, or else must be treated to acceptable standards prior to its release back into the environment.

Similar to the service water dams, PCD's are also specifically constructed facilities as they contain affected (dirty) water and are also authorized in terms of a NWA section 21(g) water use. A typical PCD layout is shown in Figure 4.8.9.6.4(a).

Figure 4.8.9.6.4(a): Typical Storm Water PCD at Shaft Complex

General Description of Dams and Ponds

The following pollution control facilities are planned:

- A PCD, located at the main inclined shaft area – **ROM Tip PCD**. The capacity of this dam will be 25000 m^3.
- A PCD, located at the workshops area – **Shondoni PCD**. The capacity of this dam will be 80000 m^3.
- A sediment trap will be located upstream of each PCD.
- A small sampling pond will be located downstream of the clean water system to allow for sampling of runoff from this area.
- A small dam (10 000 m^3) will be provided at the conveyor transfer stations to control affected runoff and spillage of water that may occur in these areas.

Safety Aspects

The need for the PCD at the workshops area (Shondoni PCD) to be classified in terms of the Dam Safety Legislation will be determined during the design phase. If classified, the design and construction will require the supervision of a suitably experienced Approved Professional Person in terms of the National Water Act, as well as requiring approval by the Department of Water and the Environment at various stages of the project.

Other safety aspects will include the provision of warning signs at the dam as to the dangers of drowning, warnings against drinking of the water and provision of emergency flotation devices. Access in and out of all water retaining structures will be ensured by means of ramps or ladders (where ramps or slopes cannot be provided).

Sizing of Dams

The sizing of the PCD's is detailed under the Water Balance. However, key features are summarised below.

Legislation

Dams are sized to have a 2% risk of spilling in any one year in line with the National Water Act. However, the dams are only part of the overall water management strategy, and as such the risk of spilling is dependent on several other components of the water management system, including:

- The actual water make as opposed to the theoretical predicted water make. A commitment is made to calibrate the water model once data is available from the site.
- The availability of storage underground compared to the theoretically predicted storage available. A commitment has been made to review the availability of storage on a regular basis, but as a minimum whenever the mine plan changes or storage conditions are found to differ from those assumed at the planning stage.

Assumptions

The assumptions used in the overall water balance model are set out in the document. These include aspects such as the following:

- The overall mining plan (given earlier in this chapter). It is likely that this plan will change as the mine develops and more information is obtained on the actual geology as opposed to that predicted at the planning stage.
- Areas where stooping will not be undertaken (also gave earlier in this chapter).
- The water use and water losses are assumed based on information collected from previous mining in the Secunda area. These will need to be refined as data becomes available.
- The surface and groundwater inflows are predicted based on geohydrological and surface runoff models, with the geohydrological information provided by JMA.

By their very nature, models are theoretical estimates of natural phenomenon that are too complex to be derived exactly. It is inevitable that there will be variations in the actual flows compared to the predicted flows that can only addressed by recalibration of modelled data with measured data, from which more reliable estimates of extreme and average water make can be developed.

Rainfall and Evaporation Inputs

The rainfall and evaporation inputs are discussed in the section on water balance modelling.

Technical Design of the Proposed Dams

The design of the Dirty Water Dams (PCD's) will be based on the principles set out below. However, the detailed geotechnical investigations required, have still to be completed which may result in changes to the final design. Any changes will be incorporated into the Water Use Licence Application.

It should be noted that none of the surface storage facilities will be used to handle water from underground, since there is both existing storage in the mined out areas to the south, as well as new storage in the areas to be mined, and these are considered adequate to handle both average and extreme water makes.

Design Parameters

Two dams are required primarily to contain runoff from the Shondoni workshops and shaft/plant areas, as well as from the ROM Tip and Stockpile area. No coal is washed in the area, and coal is generally stored in concrete bunkers, but provision has been made for an emergency throw out system, and this area is therefore considered dirty.

Embankments

As per the most recent design of dams for Sasol Mining surface water management, the dams will have an HDPE liner system underlain by a clay layer of at least 500mm. Leakage detection will also be provided.

Seepage and Siltation Minimisation

Silt traps will be provided on the upstream side of the Dirty Water Dams. These will be cleaned on a regular basis, the lack of a proper maintenance plan being the primary reason for the failure of silt trap systems.

The potential for seepage will be addressed by the use of a synthetic and clay liner system.

Inlets

Inflow to the dams will be via the silt traps on the upstream side of the dams, with water gravitating into the dam basins.

Emergency Overflow

The dams will be classified and the spillway designed for the appropriate capacity, including allowance for wave surge and run up and the freeboard required to pass the Design Flood and the Safety Evaluation Flood.

4.8.9.6.5 Sewage Plant

A modular batch (Prentec) type sewage plant will be provided at the Shondoni Shaft Complex.

The plant will include the following:

- Inlet works comprising screening facilities and emergency bypass facilities.
- A batch reactor tank in which organic constituents will be biologically oxidised, and in which mixing and aeration occur. A mechanical surface aerator will be on the batch reactor tank, either floating or fixed.
- The tank will typically be decanted 3 times a day when the volume reaches a predetermined level, using a fully automated system to manage water levels and quality.
- Clarifying and chlorination of water will occur prior to discharge of the water, the water being discharged to the water management dam for reuse in dust suppression.
- Sludge facilities will be used to store and dry the sludge, the material being discharged from the clarifier as and when required. The sludge is then dried and eventually disposed of as per the licence requirements.

These plants are self-contained systems, the maturation water discharge from which are managed to acceptable standards for either discharge into the environment, or else for storage into the Storm Water PCD.

The assumed effluent from the administration building, change house, showers and workshop without the dust suppression requirement is 90% of the Average ADD which is ((425 m^3/day) x 90%) = 380 m^3/day. The design peak is 3.8 times the Average ADD.

A typical sewage plant layout is shown in Figure 4.8.9.6.5(a).

Figure 4.8.9.6.5(a): Typical Sewage Plant at Shaft Complex

4.8.9.6.6 Excess Mine Water Management

Excess mine water is defined as the water accumulating underground in the workings and which is not used as service water by the mine, or is lost through ventilation.

Underground water seepage together with recycled polluted water to the CM's, wash bays and other consumers is collected at both seam levels. At both levels it is initially proposed to store this polluted water in corrosion resistant heavy duty HDPE open storage tanks. The capacity of these tanks will be calculated when the current geohydrological study on ground water seepage is completed. Corrosion resistant pumps installed in the tanks at the C2 Seam level will pump this polluted water to the C4L Seam level and will discharge into similar but larger storage tanks.

The polluted water at the C4L Seam level will then be pumped to the surface via one of the service boreholes through pressure rated PVC or HDPE piping. The pump head will be designed to enable the polluted water to be pumped directly to the Surface and Underground Polluted Water Dam to be located at the south side of the site, east of the 15,000 t Surface Bunker.

Rain water run - off from the Bunker and open stockpile area will also discharge into the Surface and Underground Polluted Water Dam via suitably designed oil and silt traps. Polluted Water Service pumps will return this water to the mine via a dedicated, PVC or HDPE corrosion resistant pipe line.

This Service water will be delivered into an above ground Service Water Reservoir from which a service water booster pump will deliver this water to the underground utility consumers at a pressure head suitable for operation of the CM's. Apart from feeding the various utility points a dedicated Diesel pump will supply Fire Service water to the fire hydrants and hose reels, situated at both seam levels.

It is anticipated that this Surface and Underground Polluted Water Dam will fill at a faster rate than the combined usage of recycled water. It will therefor be necessary to locate alternative water storage facilities to which the excess water can be pumped or alternatively install a Water Treatment Plant. However, the option of a Water Treatment Plant was discounted at the commencement of the study.

Currently excess mine water at Middelbult is dealt with by means of a network of underground storage dams as well as surface located Pollution Control Dams. The extent of the underground storage of mine water, as well as the handling of excess mine water pumped to surface, will be dealt with in the Integrated Mine Water Balance discussion in section 4.10 of this report.

The integrated, surface located, excess mine water management infrastructure, which deals collectively with the excess mine water generated by Brandspruit, Bosjesspruit, Middelbult and Twistdraai Collieries, is shown in Figure 4.8.7.4(a). More details on these facilities are given in the Integrated Water Management Plan (IWMP) for the Sasol Secunda Industrial and Mining Complex.

The responsibility for the effective operation, maintenance and legal authorization of the individual PCD's comprising the overall system, has been assigned to respective mining operations. Middelbult is responsible for the following PCD's forming part of the overall Integrated Mine Water Management System.

Facility Name	Capacity (m^3)
Service Water Dam West	26 400
Service Water Dam East	51 600
Small Dam 11	320 000

However, the excess mine water management system for Middelbult Colliery is not yet connected to the overall Sasol Mining Excess Mine Water Management System. The **broken blue line** in Figure 4.8.7.4(a) indicates that the pipe line to connect Midelbult Colliery to the overall system is still not in operation. The due date for commissioning of this pipe line is 2012.

4.8.9.6.7 Water Treatment Plant

No water treatment is foreseen for the operational phase at Shondoni. The mine has been planned so as to avoid the need for mine water treatment for as long as is possible. This has been achieved through the use of bord and pillar mining at the existing operations, allowing storage of surplus water in these mined out areas from the start of mining.

Further, as mining progresses, additional areas will be flooded to prevent spontaneous combustion and reduce the rate of pyrite oxidation, and the flooding of these areas will allow the predicted water make to be managed without a water treatment plant until many years after closure. There is a possibility that, with stratification of water post closure, there may not be a need to treat water even post closure, but this is not proven yet and provision has been made for treatment if required post closure.

The need for RO or similar techniques is discussed in terms of the water balance. Note that, should such a plant be constructed, it will require a full Environmental Impact Assessment, which will include detailing of the processes and management of the waste streams.

4.8.9.7 Waste Management Facilities

4.8.9.7.1 Mining Residue Disposal

No mining wastes such as discard or coal fines slurry will be generated at Shondoni. The coal will be cut from the coal seams underground and then conveyed as ROM coal along the conveyor belt to the central coal stockpile area. The overburden material excavated from the shaft during the shaft construction will be used in small amounts for berm walls and embankments at the shaft complex and will be covered with clay and topsoil before these structures are re-vegetated. The placement of these materials is dealt with in terms of a NWA section 21(g) water use authorisation.

4.8.9.7.2 Domestic/Small Industrial Waste Disposal

All household (general or domestic) and small volumes industrial wastes are separated and disposed of in bins within dedicated concrete lined and bunded structures for removal off-site by outside licenced waste management contractors.

Figure 4.8.9.7.2(a): Domestic/Industrial Waste Disposal Facilities

4.8.9.7.3 Hazardous Waste Disposal

The only hazardous wastes generated at the shaft complex relate to oily rags, fluorescent tubes and possible oil spillages onto surface at work shop and wash bay areas. A special oil trap and oil separator system is provided whereby all oil in storm water run-off is captured, skimmed and recycled.

Figure 4.8.9.7.3(a): Typical Oil Trap and Skimmer System

4.8.9.7.4 Salvage Yard

A salvage yard for non-hazardous materials will be provided at the Shondoni Shaft Complex.

Figure 4.8.9.7.4(a): Typical Salvage Yard

4.8.10 Middelbult - Block 8 - Shondoni Water and Salt Balance

4.8.10.1 Water Balance

4.8.10.1.1 Mining Factors Influencing the Water Balance

Subsidence

Subsidence is of particular importance in terms of the overall water balance, since not only do the areas of subsidence result in increased groundwater make through dewatering, but also increased surface water ingress.

Expected Location, Extent and Depth of Surface Subsidence

High extraction is planned with due consideration of the following:

- No stooping or high extraction will occur under the river systems (within the 1:50 year floodline or 100m from the watercourse whichever is the greater). Note that this applies to all major streams; for small ephemeral or non-perennial drainage lines, the 1:50 year floodline will be used.
- Areas of rocky outcrop because of both the sensitivity of some of these areas, and the potential for exposed cracking on surface with associated larger inflows.
- Areas of infrastructure are also excluded.

These areas reduce the total area available for high extraction, and current planning is for high extraction over roughly 27% of the area still to be mined at Block 8.

Planned areas to be targeted for high extraction are shown in **Figure 4.8.10.1.1(a)**.

Drainage Paths that may be Affected by Surface Subsidence

These areas are also shown in **Figure 4.8.10.1.1(a)** and will be excluded from high extraction. Mining by means of bord and pillar will be undertaken. Refer to the specialist Surface Water Report for a more detailed discussion on the risks of surface subsidence – APPENDIX 5.7(A) in VOLUME IV.

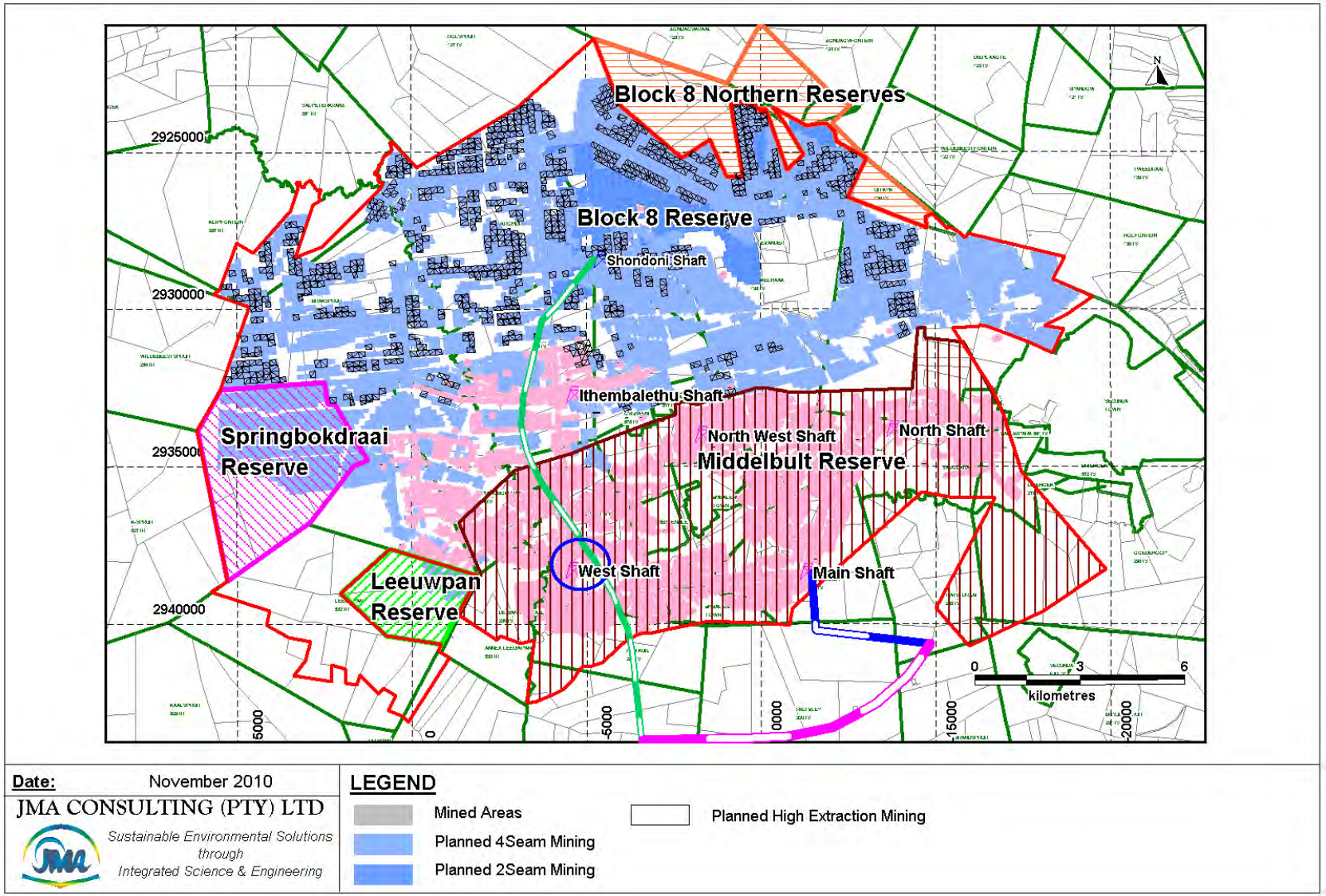


Figure 4.8.10.1.1(a): Areas Identified for possible High Extraction

4.8.10.1.2 Rainfall Data

The water balance modelling approach used historical daily rainfall data from gauges in the area. The rainfall data from Langsloot was evaluated as having reliable data, together with reasonably representative extremes for the duration of sampling. The gauge is located close to the site, and has a rainfall record from 1914 to 1998. The data was augmented by data from Secunda. A motivation for the use of this rain data is given in the baseline discussion on rainfall.

Note that there is no right or wrong rainfall gauge to utilise for the various hydrological inputs to the EMP. The Langsloot gauge has extreme rainfall data that make it useful for the water balance modelling.

4.8.10.1.3 Computational Methodology

The methodology used is detailed in the text box below.

Modelling Methodology

The daily rainfall files were input to a hydrological model based on the Soil Conservation Services method to determine runoff on a daily basis using antecedent conditions. The method (as adapted to South Africa by Schmidt and Schulze) is believed to be highly suitable to the site, having been developed in catchments of around 8 km^2 and agricultural areas.

The underground water inflows were derived by JMA Consulting using the modelling approach developed for the Secunda area. This involves developing of grids for which the recharge rates can be computed. Account is taken of recharge and dewatering through fracturing of strata.

These rates of inflow are then brought into the J &W model, where extreme rainfall impacts, and surface water make can be assessed.

From this, the water use/storage requirements to have a 2% or less risk of spilling can be computed.

4.8.10.1.4 Water Make

Water make refers to the water generated through the mining activities. This includes rainfall related inflows as well as groundwater inflows.

The total water make from the underground mining areas is given in Figure 4.8.10.1.4(a) for the period through to closure, showing seasonality. Note that these water makes include the bord and pillar areas already mined, since the storage calculations are also for both the historical and future mining at Middelbult Block 8.

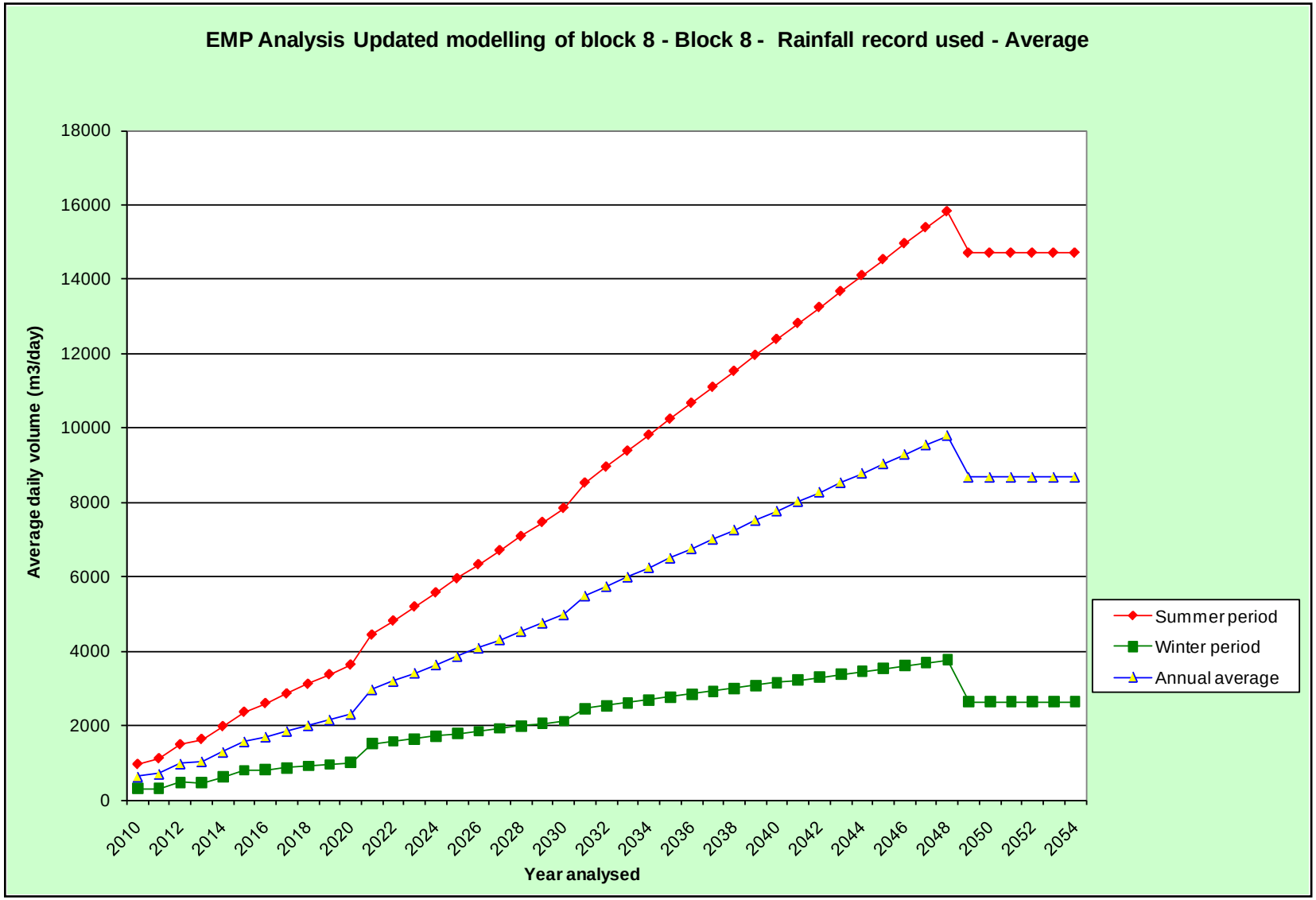


Figure 4.8.10.1.4(a): Current Predicted Water Make at Middelbult – Block 8 – Shondoni for Average Rainfall.

Key points to note include:

- The mining of 2 seam workings only commences around 2020, indicated as a small increase in the water make trend.
- Post closure, the dewatering of the aquifer associated with high extraction mining reduces, with an associated reduction in the overall water make.
- The assessment is based on a macro level review of mine water make, and there is a need for detailed review of the high extraction areas as the project progresses to ensure that inflows from non-freedraining areas are minimised.

The contribution of the various mining areas to the net water make is given in Figure 4.8.10.1.4(b).

It is apparent that the bord and pillar mining in the current workings contributes very little to the overall water make compared to the new high extraction developments to the north.

A schematic of the overall water balance for the life of the mine is given in Figure 4.8.10.1.4(c).

4.8.10.1.5 Water Use

Water use relates to water lost from the mine water circuit. This excludes water that is recycled.

The net water use includes the use of water for dust suppression, losses through the ventilation systems, and water "lost" with coal, i.e. transported with the coal to the Sasol Coal Supply (SCS).

Available information and best estimates indicate the usage to be as follows:

- Dust suppression = 200 m^3/day
- Sampling plant = 30 m^3/day
- Lost with coal = 600 m^3/day
- Lost through increasing moisture content in air in the ventilation system = 500 m^3/day

Note that although the continuous miners utilise significant volumes of water, the water is generally recycled and the losses are not attributable to the mining itself, but to "wetting" of coal mined by the equipment. The graph of water make, versus usage, given below (Figure 4.8.10.1.5(a)) indicates that there is a net shortfall of water for the initial mining period, after which water will be available. The following should, however be noted:

- The Figure indicates a net shortfall for the next 7 years. However, that assumes that water is not pumped from low lying areas within the mine i.e. that available storage underground is maximised. There will be water available for dust suppression from the underground workings.
- With the exception of dust suppression, none of the other "uses" is essential – e.g. ventilation losses will not be maximised if there is not available moisture within the mine.

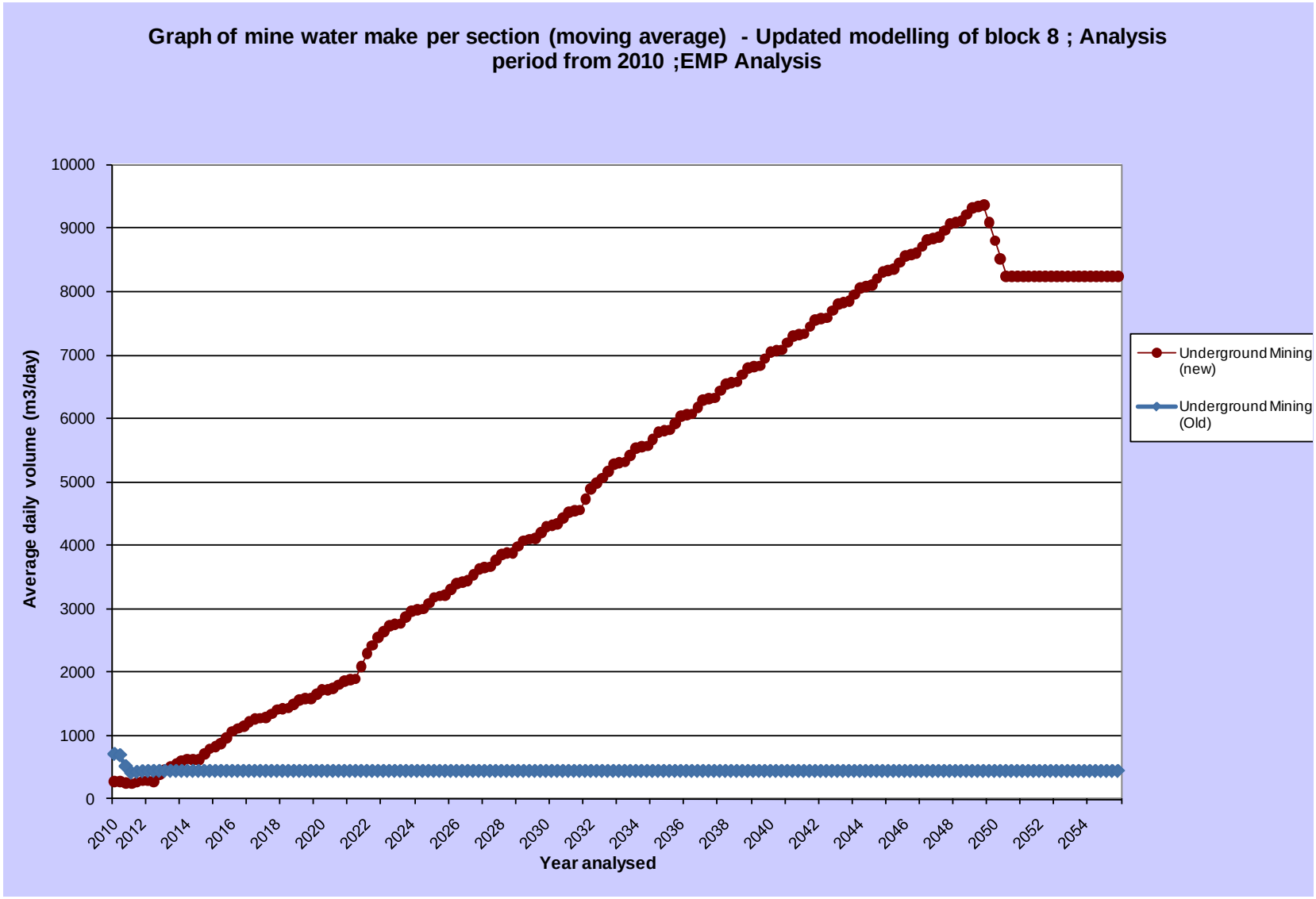


Figure 4.8.10.1.4(b): Contribution of the Various Areas to the Net Water Make

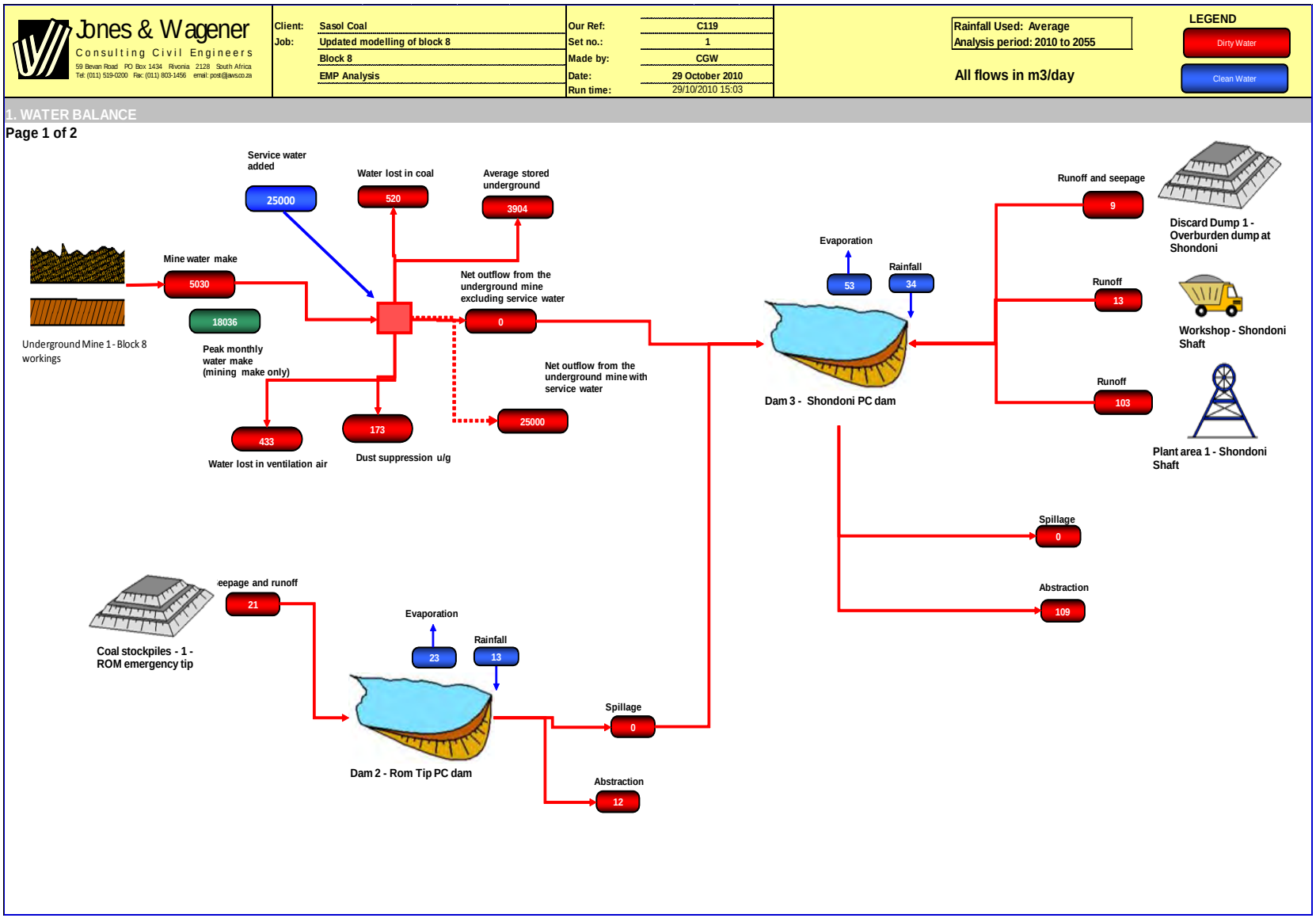


Figure 4.8.10.1.4(c): Schematic Water Balance over the Life of Mine

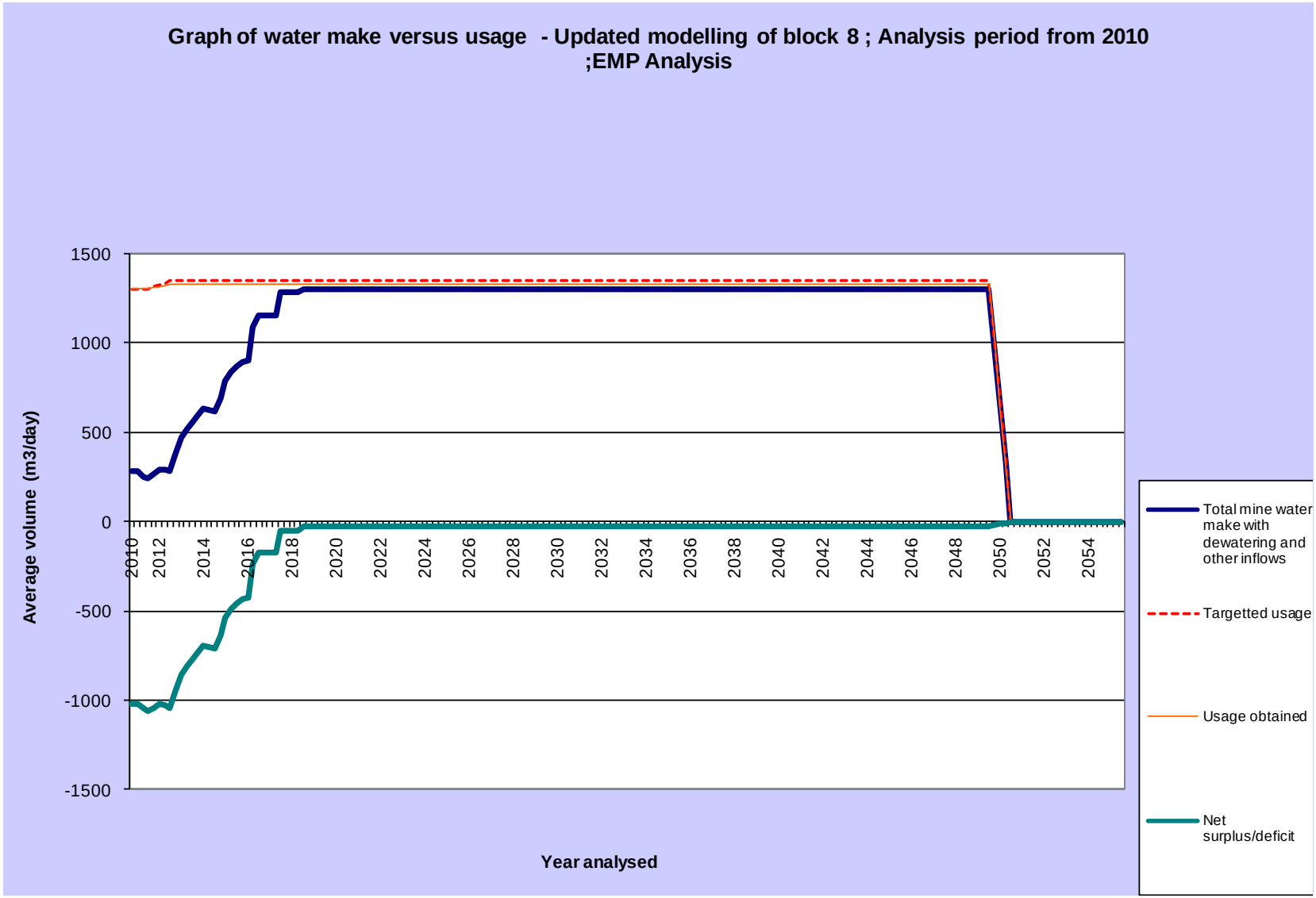


Figure 4.8.10.1.5(a): Water Make versus Water Usage

4.8.10.1.6 Water Storage

Underground Storage

As indicated previously, it is environmentally desirable to flood as much of the mined out area as possible to reduce the oxidation of pyrites and reduce spontaneous combustion risks. Because the mining to date has been bord and pillar, there is storage capacity available in the mined out workings. This is shown in Figure 4.8.10.1.6(a).

It is apparent that:

- Currently, just over 50 million m^3 of storage is available in the mined out areas at Block 8.
- Around 35 million m^3 will become available in the western areas around 2020.
- It is anticipated that around 20% of the remaining storage will become available around 2040, if not sooner.

Surface Storage

Dirty water will be stored in two dirty water dams. These are located downstream of the ROM emergency stockpile, and the shaft workshops and overburden dumps.

Modelling of the pollution control dam at Shondoni Shaft indicates that a dam of around 80 000 m^3 has a risk of spilling of 1:50 years, based on abstracting around 160 m^3/day to both the sampling plant and dust suppression underground. Some optimisation of this dam can be done at final design. The modelling output is shown in Figure 4.8.10.1.6(b).

For the ROM tip area, it is proposed to also abstract a nominal amount of water for the sampling plant and for dust suppression of some 25m^3/day, giving a required storage capacity of around 25 000 m^3 for this dam. The modelling output is shown in Figure 4.8.10.1.6(c).

From the above Figures it can be concluded that:

- Surface storage can be relatively low, provided that some levels of abstraction can be made back to underground for use in dust suppression in the workings. During the initial shaft drilling operation, there may be additional water ingress and some allowance may need to be made to remove water by tanker if required, but as soon as the site is established, the surplus water should easily be accommodated within the dust suppression requirements underground.
- The costs associated with the surface dams are not insignificant due to the relatively expensive liner system required by the authorities, and for this reason it is suggested that further optimisation may be possible at final design.

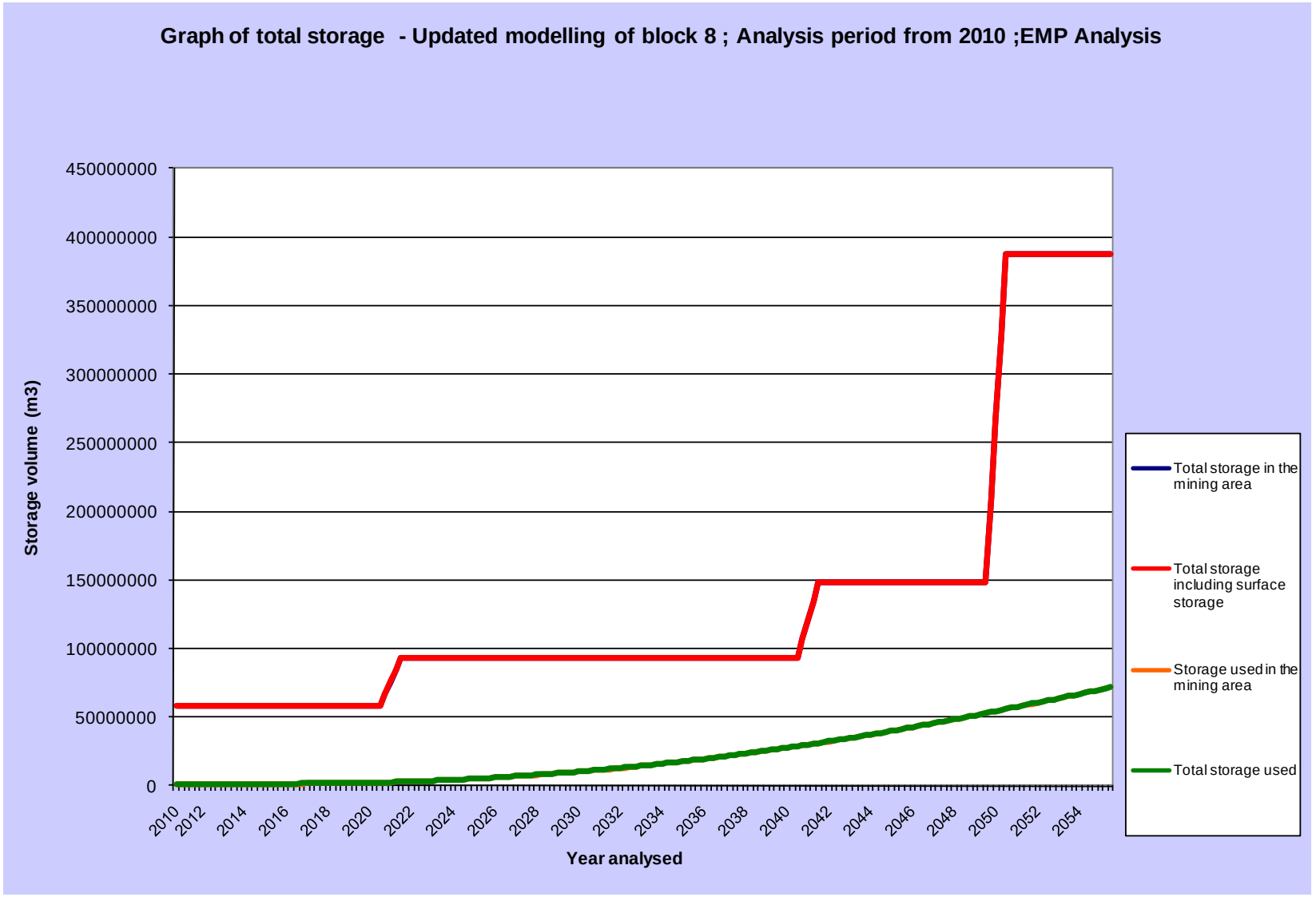


Figure 4.8.10.1.6(a): Plot of Expected Storage to be used, based on Average Rainfall

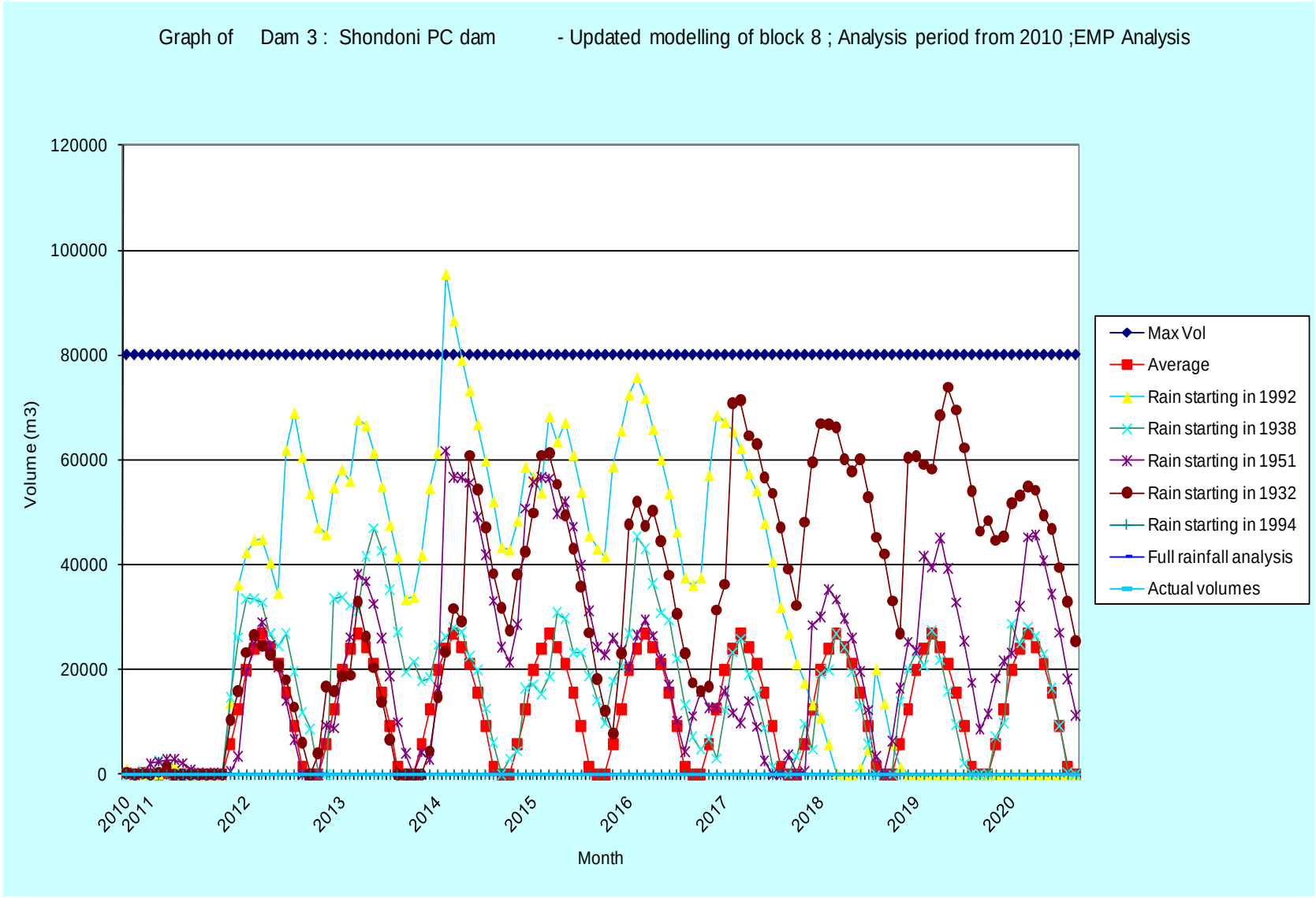


Figure 4.8.10.1.6(b): Storage required for the Shondoni Pollution Control Dam

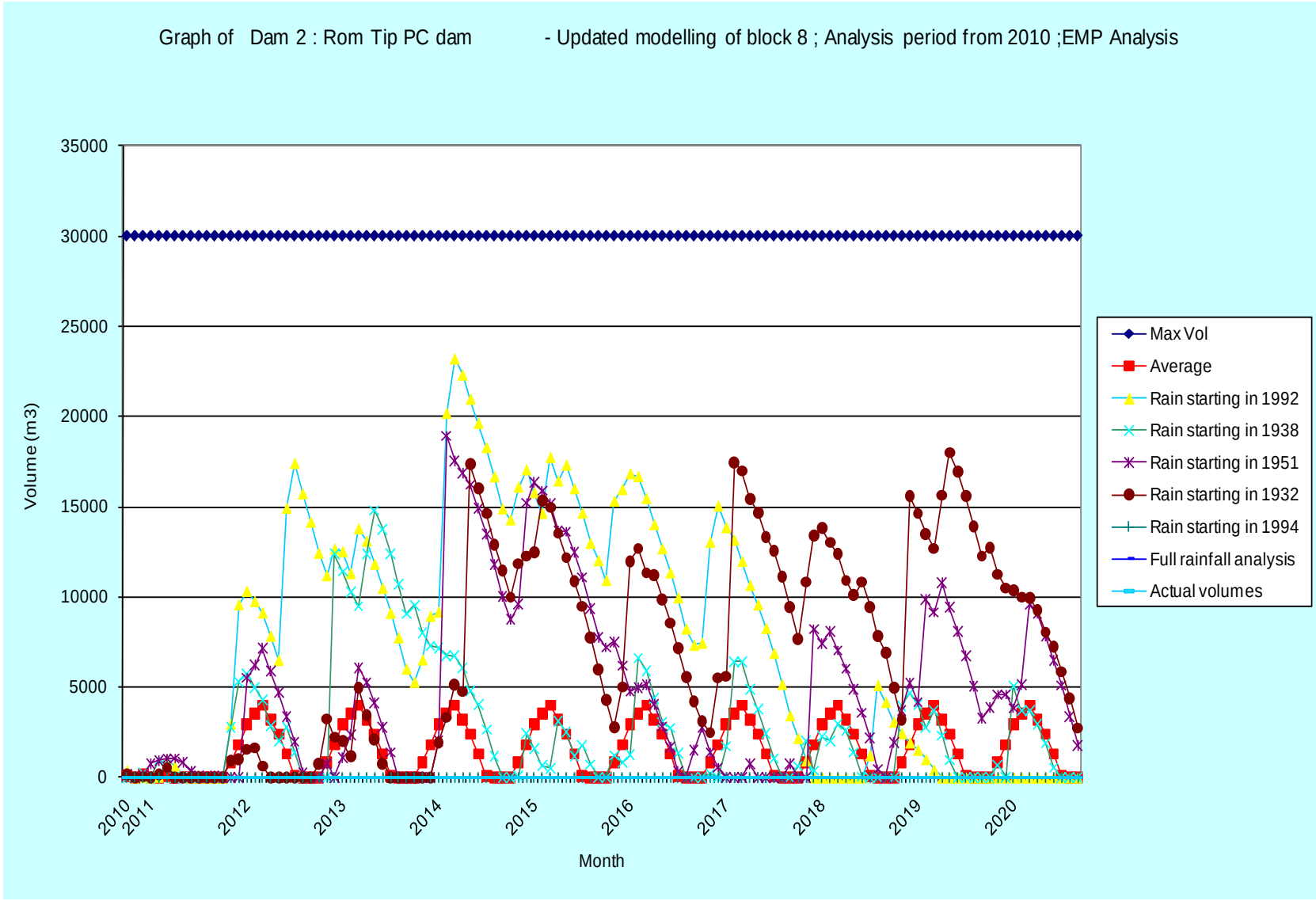


Figure 4.8.10.1.6(c): Storage required for the ROM Tip Pollution Control Dam

4.8.10.1.7 Overall Management of the Water Balance

The following is apparent:

- The storage of water within mined out areas will be effective in managing the water make over the operational phase of the life of mine.
- This assessment is based on relatively conservative values for the recharge at high extraction areas and therefore should be conservative.
- However, there is some risk in the overall strategy in that the graph of increasing available storage and increasing water make run in parallel, so that the water balance is sensitive to possible changes such as much higher than expected water make (be it due to higher rainfall or increased recharge) or loss of storage for whatever reason (such as boreholes through compartments that result in inability to maximise the flooding of certain areas).
- The above implies that ongoing monitoring and measurement will be required to ensure that, if active treatment is required during the life of mine, this can be constructed timeously.

4.8.10.2 Salt Balance

The salt balance is given below (Figure 4.8.10.2(a) for the life of the mine. This should be seen as a provisional salt balance using the water balance in the previous sections, average rainfall, and predicted water qualities for the mining area and surface infrastructure. The balance will need to be updated once actual water qualities are measured.

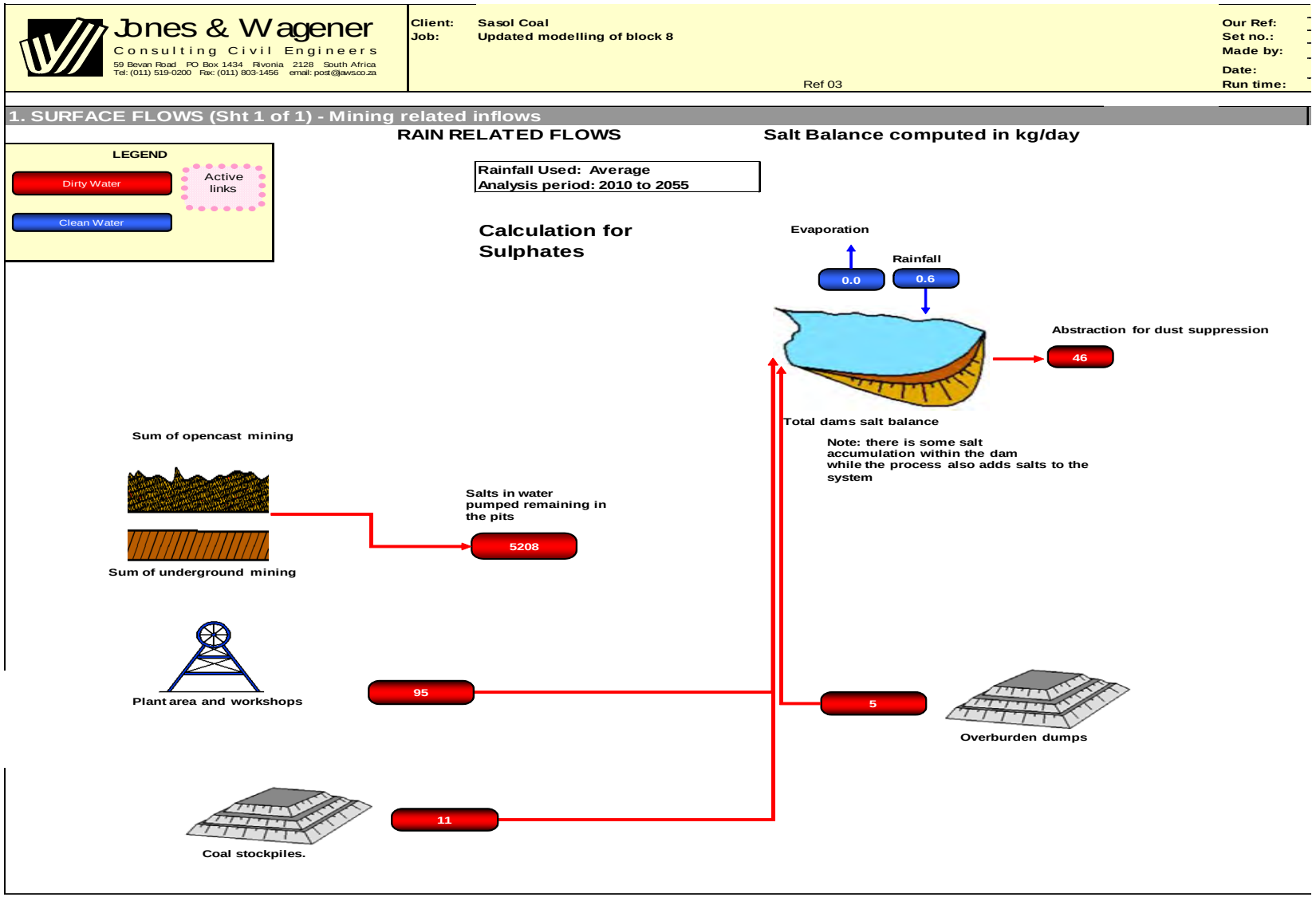


Figure 4.8.10.2(a) Salt Balance over the Life of Mine

4.8.11 Construction Phase Activity Description

Construction activities will be restricted to the Shaft Complex and its access route from the R 547, as well as along the coal conveyor servitude. The construction phase will run for approximately three years and is scheduled to commence in 2011 with completion in 2013. The mine needs to be in production by 2014.

Construction will commence with site clearance and will primarily comprise civil and building construction works of the access road, the shaft complex buildings, water pollution control measures, service water dams, as well as the vertical people and materials shaft, the incline coal conveyance shaft and the vertical ventilation shaft.

Activities will be restricted to within the different servitude areas for the access road, the shaft complex, and the conveyor route.

As indicated earlier blasting will occur during the vertical and incline shaft construction. The excavated materials from the shaft will be used to construct berms and embankments around and within the shaft complex.

All construction sites will be fenced to regulate access during the construction period.

Of particular importance during the construction phase, are the potential for stream crossings by the coal conveyor system and possibility of one stream diversion that may be required. Depending on the selected conveyor route, a number of stream crossings may be required. At the incline shaft for the proposed shaft locality, a stream diversion may be required depending on the final design. Stream crossings and river diversions are authorized as NWA section 21 (c) and (i) water uses or General Authorisations.

4.8.12 Operational Phase Activity Description

The mine will go into production in 2014 and will have an expected life of approximately 27 years. The mine will operate on a 24 hour per day basis.

During the operational phase most activities will occur underground. The two coal seams will be mined with continuous miners and therefore no routine mining related blasting will occur. However, when dolerite structures need to be penetrated to access the coal seams, limited underground blasting will occur from time to time.

The coal is cut at the mining faces, loaded automatically onto the shuttle cars from which it is loaded onto the conveyor system which takes the coal along the incline shaft to surface.

On surface the coal goes directly into the surface bunker from where it is transferred onto the overland conveyor which transports the ROM coal to Sasol Coal Supply. The surface coal bunker also has an emergency surface throw out area in the event that the conveyor system cannot handle the volume of coal as a result of maintenance. Surface activities at the shaft relate to general administration and management.

Underground personnel access the mine through the vertical people and material shaft after preparing for shifts in the change houses, where they also wash and refresh at the end of shifts.

The shaft complex also handles all materials that need to go underground and has stores and workshops to cater for repairs that cannot be done underground.

The ventilation shaft is also operated at the shaft complex and comprises the operation of extraction fans to drive the up cast ventilation system.

Apart from the operational activities, general water management and waste management is also done on surface at the shaft complex. Potable water, service water and storm water management infrastructure are located at the shaft and operated on an on going basis. Waste generated on surface is disposed in bins located in dedicated areas and removed by waste management contractors.

Water make in the underground mining sections is largely managed underground and within a series of surface located PCD's. The portion which is required for service water purposes is pumped to surface and stored in specially constructed service water dams, and then gravitated back underground for use for mining and dust suppression.

4.8.13 Decommissioning and Closure Phase Activity Description

During decommissioning and closure, equipment will be removed and sold for re-use or disposed of as scrap. The buildings will be renovated for alternative use or be demolished. Access roads, if not used, will be scarified and re-vegetated. All plant will be sold to appropriate dealers and removed from the mine property. Electrical and water supplies in the plant area, if not used, will be terminated and made safe.

The shaft entrances will be sealed according to the requirements of the MPRDA. Overburden removed from the shaft originally will be returned to the hole and compacted. Usable soil will then be replaced and contoured to be free draining. Topsoil will be replaced over this material. Final soil remediation and re-vegetation of the site will be undertaken.

Figure 4.8.15(a): Typical Closed and Rehabilitated Vertical Shaft (Middelbult North Ventilation Shaft)

During decommissioning any cracks that resulted from surface subsidence in the mining area will be filled and subsided areas made free draining.

Water levels in the workings will start to recover once mining ceases. However, the relatively low percentage of pillar extraction planned (25% of the mining area) and the isolation of these areas from the rest of the mining is likely to result in favourable conditions for decant (i.e. decant of a good water quality) over most of the area. Of the predicted decant, some 60% is predicted to be from the areas of pillar extraction, with the balance from the areas of bord-and-pillar mining.

The high extraction compartments are expected to fill nearly three times faster than the bord-and-pillar compartments, and these areas may require water to be actively extracted and managed within 30 years of mine closure. Should the compartments remain separate as intended, this will delay the onset of decant from the areas mined by bord-and-pillar methods.

Various options remain to manage the pillar extraction compartments, including placing this water into the base of bord-and-pillar compartments (if this can be done without affecting stratification of these compartments) and/or management as part of the Synfuels Complex water balance. Options of moving water between compartments will be evaluated and submitted to the authorities if and when applicable. A commitment will be given to actively manage water from the high extraction compartments if required, as well as to monitor, reuse and treat (if necessary, but considered unlikely) the water in the bord-and-pillar areas.

4.8.14 Post Closure Phase Activity Description

It is envisaged that during the Post Closure Phase the surface infrastructure which has not been demolished will be used for alternative purposes. In the remainder of the mining area it is expected that the current pre-mining land uses will be able to continue.

The only significant post closure residual impact that could occur, relates to possible decant of contaminated water from the underground mine if proper management is not followed. Various options to manage this residual impact exist. The selected methodology and technology will be formalized during application for Closure.

4.9 PROJECT ALTERNATIVES

The consideration of realistic project alternatives, with inclusion of the "No-Go" alternative, is a minimum requirement of the EIA regulations.

4.9.1 Identification of Alternatives

During the scoping phase of the project, the following list of alternatives to be considered was submitted for consideration to the I&AP's as well as the authorities. The list was compiled after due consideration by the applicant, the consulting engineers and the environmental scientists taking due cognizance of the nature and extent of the proposed project. The list is deemed to represent realistic aspects for the specific project.

- The Mining Method
- Location of Shafts
- The Mining Plan
- Transport Methods for Water, Electricity and Coal
- Transport Routes for Water, Electricity and Coal
- Surface Handling of Coal
- Domestic and Industrial Waste Disposal
- Mine Water Management
- Storm Water Management
- Alternatives to Stream Crossings and Diversions
- Post Closure Land Use for Shaft Area
- The No-Go Option

4.9.2 Process/Method for Selection of the Preferred Project Alternatives

Alternatives were firstly assessed by the applicant in consultation with the mine design engineers and the Environmental Assessment Practitioner. In certain instances the technical design considerations, as well as financial realities, eliminated alternatives which werer deemed to be viable. For alternatives which remained, and once agreement was reached on viable alternatives for a specific aspect, the alternatives were then presented to potentially affected parties for consideration. The conveyor route is a good example. This method was selected to give compliance with the *DEAT Guideline 5: Assessment of Impacts and Alternatives*.

The assessment of alternatives and the selection of the Preferred Alternative, was where possible done with the aid of numerical evaluation matrices. Although not always applicable to all the alternatives, the utilization of such decision matrices provides a useful tool for the assessment of especially the more technically oriented alternatives.

The decision matrix provides for the inclusion of a series of aspects related to:

- Technical Practicability (includes cost)
- Environmental Acceptability, and
- Socio-Economic Considerations

4.9.3 Assessment of Alternatives

The ultimate objective for alternative consideration is the selection of the BPEO (Best Practicable Environmental Option). A short discussion on the consideration of alternatives will be given. Where additional information is available, it will be refenced in the text.

4.9.3.1 The Mining Method

Coal mining can be done either as open cast or underground mining. As a result of the depth of coal at Middelbult – Block 8 – Shondoni, opencast mining is not possible and therefore only underground mining methods are viable.

For underground mining, three major methods are used:

- Bord and Pillar Mining, whereby a limited percentage of the coal seam is removed from "bords", whilst "pillars" of coal are left behind in order to support the overlying geological formations. This type of mining ensures a stable overburden and no surface subsidence occurs in mined out areas.
- Increased or High Extraction Mining, whereby sections of the pillars left behind are removed during retreat from certain mining areas. Depending on subsurface conditions, "quartering" or "halving" of pillars are perfomed. Although the intention is to maintain overburden and surface stability, instability and eventual surface subsidence can ocur if pillar failure occurs with time.
- Total Extraction Mining, whereby the entire coal seam is removed. This type of mining is done through "long walling" or "short walling" where the entire coal is seam thickness is cut from the work face, with controlled collapse of the overlying strata, or else through "stooping" when entire coal pillars are removed during retreat from bord and pillar sections. This type of mining results in definite instability, mostly also in surface subsidence, both of which cause increased influx of ground water and surface water into the mine, as well as aquifer dewatering of overlying aquifers.

With the view of minimizing the negative environmental consequences of coal mining, Middelbult – Block 8 – Shondoni has opted for Bord and Pillar Mining with selective High Extraction Mining, in pre-defined mining areas. The selection of these pre-defined High Extraction areas is discussed in the section on the mining plan – 4.9.3.3.

4.9.3.2 Location of Shafts

The location of shafts is an involved procedure (dependant on a host of economical, practical, geological, mining, safety (including ventilation) and environmental (visual, noise, dust, water) considerations) and is done in order to ensure optimal access to, and recovery of, coal from new reserves.

Due to the high costs involved in establishing new shafts, their locations are selected very carefully to present the optimal blend between all the relevant considerations. In the case of the proposed Shondoni Shaft, special consideration was also given to environmental considerations, particularly to protect surface drainage features from impact.

In this regard the construction angle of the incline shaft bears mention. The original design angle of decline of 17 degrees was changed to a decline angle of 12 degrees. This was done to protect a surface drainage feature. Due to the shallower decline angle, the shaft is now much longer and will incur a significant cost implication to the mine.

4.9.3.3 The Mining Plan

The proposed mining plan was taken through a number of iterations to ensure that due consideration was given to environmental considerations.

High extraction coal mining can manifest as instability in the overlying geological sequence with surface subsidence occurring in the event that the instability propagates all the way from the mined coal seam to the surface. The instability and eventual surface subsidence not only impact on the integrity of the surface and surface infrastructure, but it has a secondary effect in that the overlying aquifers above the mined coal seam(s) dewaters quite rapidly with the result of draining the ground water resources of the overlying land owners into the mine workings. The water entering the mine workings cause mining difficulties and has to be removed from active mining areas.

The ultimate manifestation of this type of impact occurs when "total extraction" mining ("long wall mining", "short wall mining" and "stooping") is practiced. In view of mainly the ground water related impacts associated with this manifestation, Sasol Mining in general has opted out of using this mining technique. It will not be considered at Middelbult - Block 8 - Shondoni.

High extraction mining, which will be considered for selected areas, represents selective pillar mining (usually only parts of any given pillar is extracted), and although subsidence does not usually result from this type of mining, it can occur in extreme conditions.

As part of the ground water specialist study for this project, JMA Consulting has applied a ground water driven mine design tool (specifically developed for Sasol Mining), whereby sensitive areas for high extraction mining (in terms of potential aquifer dewatering and mine water make) can be identified, based on topographical, soil, geological, hydrological and mining configuration information.

The proposed mine plan discussed elsewhere in this document (section 4.8.9.2.6), was designed with due consideration of the above.

4.9.3.4 Transport Methods for Water, Electricity and Coal

Where-ever possible, Middelbult Mine transports all utilities and ROM coal underground. Water is conveyed in pipes, electricy in cables and coal on shuttle cars and conveyor belts.

On surface, coal is transported along surface coal conveyor belts. The only existing conveyor belt on surface runs from the Middelbult Main Shaft towards Sasol Coal Supply (SCS) where the ROM coal is processed for use at Sasol Synfuels.

For the new Shondoni Shaft, undergroung mining, water management and access constraints have necessitated that ROM coal be brought to surface at the shaft, and then must be conveyed to SCS. Between the two options of transport, namely either by road in trucks, or by overland conveyor, the overland conveyor option is the preferred alternative from just about all perspectives (financial, maintenance, practical, environmental, safety, etc).

The proposed overland conveyor will be located in a dedicated servitude. In the event that either electricy, or water, or both need to be conveyed on surface, the reticulation will occur within the same servitude as the overland conveyor. This is to minimize environmental disturbance and to optimize maintenance and security aspects.

4.9.3.5 Transport Routes for Water, Electricity and Coal

The supply of water and electricity to the proposed Shondoni operations will be from external service providers ESKOM and Rand Water. The routes for transport will be largely determined by these service providers as a function of availability and existing reticulation layouts.

As far as the overland coal conveyor route is concerned, a comprehensive route selection exercise, including Public Participation, was conducted. A separate study report titled: **Sasol Mining – Middelbult (Block 8) Shondoni Project – Alternatives Assessment Overland Conveyor**, was compiled and is attached as **APPENDIX 4.9(A)** to this EIAR IN VOLUME IV of the documentation.

From 3 alternatives, the preferred alternative was identified as the western route. However, although by far the preferred route from most perspectives, the route had one major drawback in the sense that it ran past two residential settelemnts namely Brendan Village and eMbalenhle. Based on comments from the I&AP,s the route alignment was changed to accommodate the concerns of the I&AP's. The route now proposed, is therefore an adaptation of the western route which is now more acceptable to the I&AP's. The outcome of this exercise illustrates the benefit of collective decision taking as intended by the EIA process.

4.9.3.6 Surface Handling of Coal

The mine design for Shondoni was optimized to minimize the surface handling of coal. The only place, except on the overland conveyor, where coal will be handled on surface, will be at the emergency throw-out coal stockpile at the coal surface bunker, located at the head of the incline shaft. This area represents an emergency facility in the event that normal operation of the bunker discharge system onto the conveyor is compromised.

4.9.3.7 Domestic and Industrial Waste Disposal

Historically Sasol Mining disposed of all domestic waste at an internal waste disposal facility – the Charlie I landfill was a permitted facility. However, the site has been decommissioned and therefore all domestic and industrial waste generated at the shaft complex will be temporarily stored in specially prepared and demarcated areas at the shaft and will then be removed by licensed contractors to licensed landfill sites, or other appropriate facilities.

4.9.3.8 Mine Water Management

Mine water management at the mine will be managed in accordance with the requirements of the National Water Act, and in fulfilment of the conditions contained in Regulation GNR 704, which regulates *inter alia* storm water management at mines.

During the operational phase, re-use of dirty water is expected to be less than the water make from mining.

The following hierarchy of water management will apply:

Step 1: Implement pollution prevention at source
Step 2: Implement reuse and minimisation strategies
Step 3: Treatment

To achieve the first two steps, the following measures have been implemented:

- Pillar extraction has not been planned for any areas with shallow cover, with a mining depth of less than 80m. This is to reduce the risk of significant impacts on surface.

- Pillar extraction has been excluded from the following areas:

  - Low lying areas within the mine that are usable as primary storage compartments underground. These areas will be mined bord-and-pillar so as to maximise the available storage underground in the operational phase.

  - Areas with a high risk of significant inflows, such as areas with shallow soil cover, and any rivers or drainage lines. Some of the areas targeted for pillar extraction do have rocky outcrops, and these areas will be surveyed in more detail prior to mining to ensure that rocky outcrop are not undermined as far as is practical, so as to avoid significant inflows.

  - Areas that will be mined by pillar extraction have been planned as separate compartments that can be isolated from the rest of the bord-and-pillar mining post closure, to maintain water quality. Extensive studies have been undertaken to quantify the primary contributors to the mine water make, so that the water make can be minimised.

- Similarly, the geochemistry of the mine water has been investigated to assess the extent to which the quality of the water make can be maximised. Middelbult generally has a more favourable water quality compared to some of the other mining areas in the Secunda Mining Complex.

- As far as is practical, mining is planned so that the low lying areas of the reserve (in terms of coal floor contours) will be mined as quickly as possible. Mining will then move to the higher lying areas, thus permitting water to be left behind or stored in compartments with low pressure seals.

- Dewatering of active areas is planned to allow rapid dewatering to surface of better quality water, in order to prevent deterioration in water qualities. This implies that the circulation of water underground will be minimised as far as is practical. This water will be reused in the plant and coal processing systems.

- As indicated previously, bord-and-pillar areas that have the potential to have stratified water qualities post closure, with a low risk of decant of water affected by mining, have been identified and will be isolated from areas of pillar extraction by means of seals.

However, it is accepted by the mine that, despite the proposed measures to minimise the water make and maximise the reuse of water generated from mining, there will be a water surplus, and water management will be required.

The scenario post closure is that some compartments will potentially stratify with a low risk of decanting water of a poor quality, while others (where pillar extraction has occurred) will have a high risk of decanting poor quality water.

Provision has been made and a commitment given in the EMP to treat any mine water discharged to the surface water catchment post closure. The financial provision for closure is also discussed in the EMP.

The anticpated treatment costs are as follows:

- The membrane technology is estimated to have treatment cost of about R 15/m^3 including capital and operating cost. This includes a crystalliser facility.

- For bord-and-pillar mining with selective pillar extraction (as discussed above), the annualised cost during the operational phase is estimated to range from R0.28million in the first year of mining to R2,2million by Year 2011. Thereafter, no additional costs will be incurred, with the underground storage compartments being utilised. Using the current best estimate in terms of operational and post closure water makes, in present value terms at a 6 % discount rate, the cost is estimated to be R5million total cost from commencement of mining to closure.

- This compares with figures for pillar extraction from the start of mining and over large proportions of the mines of up to R140 million annual cost towards the end of mining, although reduced by storage underground to around R 40 million. The present value of operational costs were computed to vary between R200 and R600 million (again 6% discount rate) for a largely pillar extraction mine, the variation being based on the degree of storage generated underground.

- Even with the delayed pillar extraction mining, the cost if storage is not obtained, as indicated in the proposed plan, is (after discounting) around R140 million.

The optimised layout indicates that the initial bord-and-pillar mining within the first 8 years can provide water storage for the remainder of mining, thus significantly reducing the overall treatment costs. This is a key component of the mining strategy.

It is important to note that these costs are not the definitive costs, since there is further optimisation that is discussed and detailed in this document, but it represents a first estimate of the possible cost implications of water management if not properly optimised.

The post closure costs are estimated to be around R18 million per annum for the initial pillar extraction decant (without neutralisation), increasing to some R 30 million per annum once the bord-and-pillar areas begin to decant. However, this costing assumes the bord-and-pillar decant will require treatment, which is not the case. The delay in decant post-mining results in an estimated discounted cost of around R 12 million in present value terms.

Not more than 25% of the total mining area north of the dyke will be mined using pillar extraction techniques, while no pillar extraction mining will take place south of the dyke (mined from Middelbult).

4.9.3.9 Storm Water Management

Storm water management at the shaft complex will be done in accordance with the requirements as specified in regulation GN 704 of the NWA, which deals specifically with mine water management at mines. This will involve the separation of clean and dirty water at the shaft with a series of berms, cut-off canals and bunds around dirty areas. Clean water will be diverted around and off the site whilst dirty water will be captured and contained in a Storm Water Pollution Control Dam with an oil trap.

The topography of the site is such that there is a natural slope on either side of a hill. The People and Materials Shaft will be located on the brow of the hill. After earth works, terracing and paving these natural slopes will have been retained. Full use is made of the natural topography such that the clean buildings being the main entrance, general offices, management offices and parking are all located on the south east slope. Thus the Storm Water falling on this slope will always be clean and as such can be discharged to the existing stream located south of this slope.

Situated on the north east slope are the potentially dirty buildings, being the Diesel Workshop, oil stores and other buildings, all with the possibility to contaminate Storm Water. This entire area will be curbed and where necessary bunded, to channel all Storm Water into the **Shondoni Pollution Control Dam**.

At the exit of the Incline Shaft and the Surface Coal Bunker and Emergency Coal Throw Out area, as second "dirty water area" will also be isolated. This entire area will be curbed and where necessary bunded, to channel all Storm Water into the **ROM Tip Pollution Control Dam**

In terms of the requirements of GN 704 of the NWA, polluted storm water run-off must be contained in a specially constructed Pollution Control Dam (PCD) and may not be discharged into any water resource without DWA authorisation. The water in the PCD can be reused on the mine, or else must be treated to acceptable standards prior to its release back into the environment.

Similar to the service water dams, PCD's are also specifically constructed facilities as they contain affected (dirty) water and are also authorized in terms of a NWA section 21(g) water use.

The **Shondoni Surface PCD** will be located on the lower slope of the hill, beyond the site paved area where maximum use of the natural topography will be utilised to create a lined storage dam with a capacity of 80 000 m^3. This dam will also take purified sewage effluent as well as overflow water from the diesel workshop oil skimming unit. Grit traps will be placed on the inlets to the dam. This dam will be sized to take storm water surges. In the future it may be necessary to consider further retention measures or a water treatment facility when additional area run off details have been determined.

The **ROM Tip Surface PCD** will also be located on the lower slope of the hill where maximum use of the natural topography will be utilised to create a lined storage dam with a capacity of 25 000 m^3.

The construction of the Surface Pollution Control Dam facilities will be from the excavated material emanating from the Decline and Vent Shaft, providing this spoil material is suitable for this purpose, otherwise graded material may need to be imported. Controlled run off from the north east slope into this dam could be utilised for later construction activities as well as supplying water for start up.

4.9.3.10 Alternatives to Stream Crossings and Diversions

Alternatives for these have been considerd during the conveyor route selection as well as during the incline shaft design.

For the final conveyor route selected, one additional stream crossing had to be included due to moving of the conveyor to accommodate noise and safety concerns from residents in eMbalenhle.

The alternative selected for the incline shaft angle of decline, was selected at significant cost to Sasol Mining, in order to protect a surface drainage line and to prevent a diversion.

4.9.3.11 Post Closure Land Use for Shaft Area

The land affected by the shafts and conveyors will be returned to agricultural use after mining. Over the rest of the area land use will remain unchanged.

Should a viable post closure use by found for the shaft surface infrastructure such as the offices, workshops, change houses, etc, such potential uses will be assessed for viability and a decision will be taken accordingly.

4.9.3.12 The No-Go Option

If the proposed Shondoni project does not proceed, coal for Sasol Synfuels will have to be sourced from Sasol Mining or non-Sasol Mining reserves further away, affecting the economic viability of its existing and future production. The new mine is required to sustain coal production and feedstock to the plant as existing mines come to the end of their life. Without this substitution, significant staff layoffs can be expected, severely impacting the socio-economic structure of the Secunda area.

5. CURRENT ENVIRONMENTAL STATUS

The current environmental status has been described for the Middelbult-Block 8 reserves for the compilation of the Middelbult EMPR (approved in 2002) and for the Block 8 EMPR Addendum (approved in 2004). This current document was compiled to serve as an EMPR Addendum in order to authorize a new shaft (Shondoni Shaft) with its associated mining and surface coal conveyor, within the Block 8 reserves, but also to apply for three additional reserve blocks namely Leeuwpan, Springbokdraai and the Block 8 Northern Reserves.

Whereas the base line descriptions for both the Middelbult and block 8 Reserves were therefore already available, additional studies were conducted within the newly applied for reserve blocks. The same specialist consultancies used for the Block 8 base line studies, were again appointed to perform the additional work, with specific instructions to ensure seamless integration of the existing descriptions with the descriptions of the newly added areas.

Unfortunately, the level of detail, especially on base line maps, available for the old Middelbult Reserves, was in most instances not nearly sufficient to be able to populate the new maps to include the old Middelbult Reserves. However, the base line descriptions in the text was adapted to also portray the descriptions contained in the original Middelbult EMPR. Representing formally approved base line descriptions, the information for the existing Middelbult and Block 8 Reserves could not be upgraded as it would then override previously approved information.

Additional base line work (in addition to existing Middelbult and Block 8 descriptions) performed to cover specifically all activities related to the proposed new Shondoni Shaft, the proposed new overland coal conveyor, the three new reserve blocks, as well as the adapted mine plan related to the Shondoni Shaft and extraction of coal from the new reserves, included work related to the following:

- Topography
- Soils
- Land Capability and Land Use
- Geology
- Ground Water
- Surface Water
- Plant Life
- Animal Life
- Aquatic Ecosystems (Streams, Wetlands, Pans)
- Noise
- Visual Aspects
- Heritage Aspects
- Socio-Economic Aspects (New Sasol Mining Social and Labour Plan)

The remainder of the base line descriptions were based on the most recent descriptions as contained in the Block 8 EMPR Addendum, which are still believed to be relevant to the study area.

- Meteorology
- Air Quality

5.1 METEOROLOGY

Climatic data for the greater study area was obtained from the Weather Bureau for the Bethal weather station, which has records of weather conditions in excess of 60 years.

5.1.1 Mean Monthly and Annual Rainfall

The mean annual precipitation for the area is 711 mm which occurs as showers and thunderstorms, and falls mainly from September to April. The winter months of June, July and August are dry and their combined rainfall comprises only 3.9% of the total annual precipitation. The mean monthly and annual rainfall of the Bethal station is shown in Table 5.1.1(a).

Rainfall exceeding 1 mm occurs on 71 days annually. On only 25 of these days rainfall exceeds 10 mm. Showers of less than 10 mm account for about 50% of the annual rainfall. The maximum 24 hr storm event of 117 mm was recorded on 26 December 1940. Peak evaporation occurs during December, and is equivalent to a mean daily evaporation rate of 6.3 mm. In winter the evaporation rate falls to below 3 mm per day. The mean monthly Class "A" pan evaporation for Bethal is shown in Table 5.1.1(a).

Table 5.1.1(a): Rainfall and Temperature data for Bethal (478/808)

Month	Average Rainfall	Max Rainfall 24 hrs	A-Pan Evaporation	Mean Monthly Temperature	Ave Daily Temp (°C)	
	(mm)	(mm)	(mm)	(°C)	Max	Min
Jan	146	90 (11/1935)	180	19.5	25.8	13.2
Feb	75	96 (09/1953)	153	19.2	25.4	13.0
Mar	61	90 (07/1949)	150	18.0	24.5	11.4
Apr	48	64 (01/1964)	111	15.2	22.1	8.1
May	14	66 (23/1936)	94	11.7	19.6	3.8
Jun	7	30 (01/1942)	81	8.4	16.9	0.0
Jul	6	35 (03/1943)	90	8.5	17.1	0.2
Aug	13	29 (08/1983)	135	11.5	20.1	2.9
Sep	28	48 (29/1973)	176	14.8	23.1	6.5
Oct	78	65 (28/1956)	191	17.2	24.5	9.9
Nov	129	96 (14/1959)	170	18.0	24.5	11.4
Dec	106	117 (26/1940)	198	19.0	25.4	12.7
Annual	711	117 (26/12/1940)	1729	15.1	22.5	7.7

Bethal Record 1920 -1996

5.1.2 Mean Monthly Maximum and Minimum Temperatures

The area has a temperate climate with warm summers and cold winters with sharp frost. Generally summer temperatures are mild with an average of only 8.2 days annually, on which recorded maxima are above 30°C. Winters are cold with an average 41.4 days recorded below 0°C and 102.2 days recorded below 5°C, annually.

June is the coldest month when the mean monthly minimum has been as low as –5.7°C. An absolute minimum of below -11°C has been recorded. January is the hottest month with temperatures occasionally above 34 °C. The diurnal range, particularly in winter, is high with a maximum of 17.3°C in August and a minimum of 12.4°C in February.

5.1.3 Wind Speed and Direction

The prevailing winds in the area blow from the southwest and northwest in winter and from the east and northwest in summer.

5.1.4 Incidence of Extreme Weather Conditions

Severe frost can occur at times with the average first and last days of frost being 21 May and 1 September, respectively. The average duration of the frost period is 103 days. Extreme first and last dates of recorded frost over a period of 30 years are 15 April and 18 October respectively.

Bethal receives 3 hailstorms on average annually. These storms are most prevalent in early summer. Snowfalls are a rare occurrence with the last recorded snowfall in the Secunda area in September 1981.

5.2 TOPOGRAPHY

5.2.1 Regional Topography

The regional topography of the study area will be described at the hand of formally published topographical information as available from the 1: 50 000 South Africa Topographical Map Series. The Middelbult – Block 8 – Shondoni Mine Lease Area is located on four of these maps namely 2628 BD, 26 29AC, 2628DB and 2629CA. JMA Consulting purchased the electronic versions of these maps from the Surveyor General and extracted relevant topographical information for the purposes of this report. Figure 5.2 .1(a) shows the 20 m surface topographical contour for the study area, together with the surface drainage lines indicated on the 1: 500 00 topographical maps. The Mine Lease Boundary is indicated with a red line, also showing the different Reserve Blocks of the mine.

The entire Middelbult – Block 8 – Shondoni Mine Lease Area, falls, with a small exception in the far northern part of the Block 8 Northern Reserves, within the Vaal River catchment. The north eastern flank of the reserve area coincides with the regional surface topographical divide between the Olifants River Catchment to the north and the Vaal River Catchment to the south.

The study area stretches for some 25 km from west to east and some 20 km from north to south and generally slopes from north to south. The surface elevation in the north along the catchment divide is some 1 680 m amsl and slopes down to 1560 m amsl in the south. The ground surface is gently undulating with steeper slopes next to the surface streams.

The surface water run-off from the entire study area, with the exception of a small area in the far north, drains along 4 major stream systems towards the Vaal River in the south. The westernmost stream system is a combination of the Kaalspruit and the Rolspruit. It drains in a generally south-easterly direction and joins the Waterval River in the far south of the study area.

The Waterval River, which essentially drains from north to south, runs to the east of the former system, and represents the main surface drainage feature which conveys all the surface run-off in the study area to the Vaal River. Due east from the Waterval River, and draining from the north-east, is the Grootspruit. It comprises two mien tributaries.

The easternmost stream, and which drains the area from the east, is the Trichardtspruit. This spruit system comprises the Trichardtspruit and the Bossiespruit, which between the two, drain all surface runoff from the Sasol Secunda Synfuels Complex.

Figure 5.2 .1(b), represents a shaded relief map of the study area. This map is useful in obtaining an understanding of the general relief/morphology of the study area. The drainage valleys of the Waterval River, the Grootspruit and the Trichardtspruit is clearly visible on the map. The green line on the map indicates the alignment of the proposed Shondoni surface coal conveyer system, which shows its selection on essentially high ground in between the Waterval River and the Grootspruit. It does however cross both the Grootspruit and the Trichardtspruit in the south.

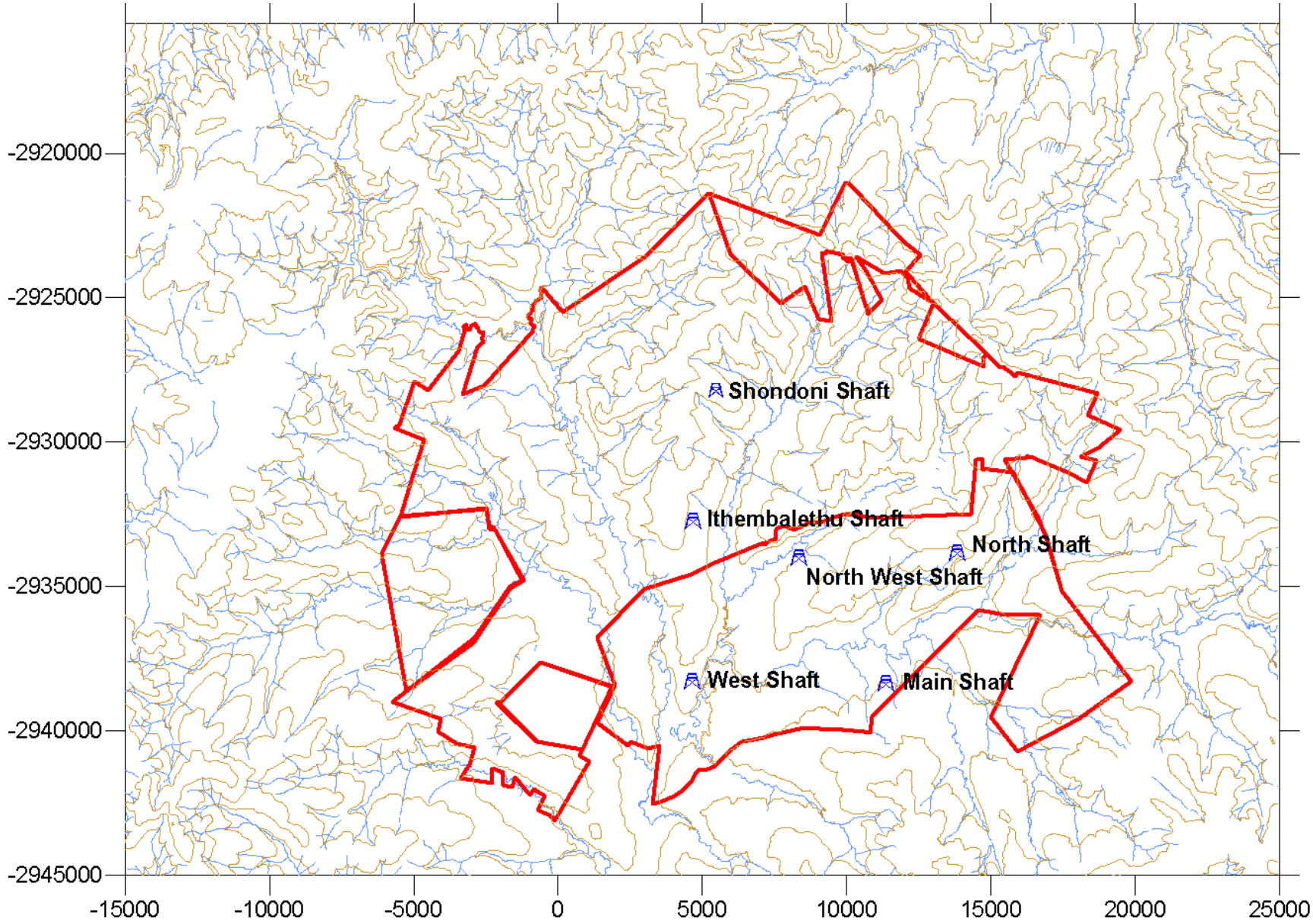


Figure 5.2.1(a): Topographical Contours (20 m) and Surface Streams in the Study Area.

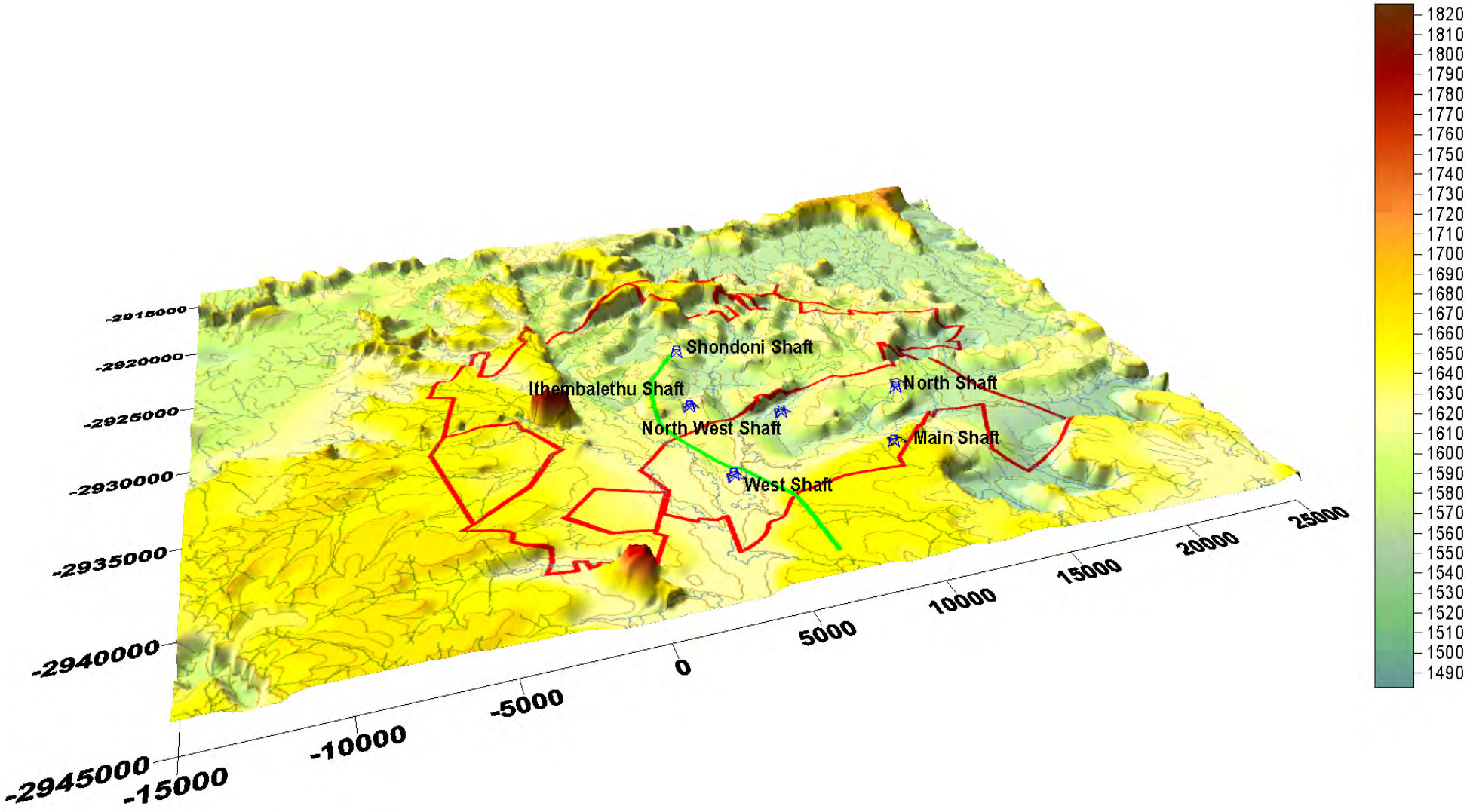


Figure 5.2.1(b): Tilted Shaded Relief Map of the Study Area

5.2.2 Detailed Local Topography

In addition to the regionally available topographic information Sasol Mining have also generated more detailed surface topographical information at intervals of 2 m. This information represents critically important base line data base from which to assess any surface subsidence which may result from increased/high extraction coal mining on the No C4L seam, which is located on average some 117 m below surface. Should full collapse occur at this depth, subsidence of the order of between 1.5 m and 2.0 m could manifest on surface.

The available information for the Middelbult/Block 8/ Shondoni Area, at 2 m contour interval resolution, was used to generate 4 surface topography contour maps at 2 m contour interval resolution. Similar maps, compiled from post mining surface topographical data of the same resolution, would clearly highlight any surface subsidence, should it in fact have occurred.

The four maps, covering the entire Middelbult/Block 8/ Shondoni Mine Lease Area are shown in:

Figure 5.2.2(a) – North Western Quadrant
Figure 5.2.2(b).- North Eastern Quadrant
Figure 5.2.2(c) – South Western Quadrant
Figure 5.2.2(d) – South Eastern Quadrant

The maps could of course be generated to a higher accuracy through zooming into smaller areas as it may be necessary to assess surface subsidence conditions in smaller areas. The raw surface elevation point data, known as a Digital Terrain Model (DTM), will be stored on the Sasol Mining Data Base for future reference.

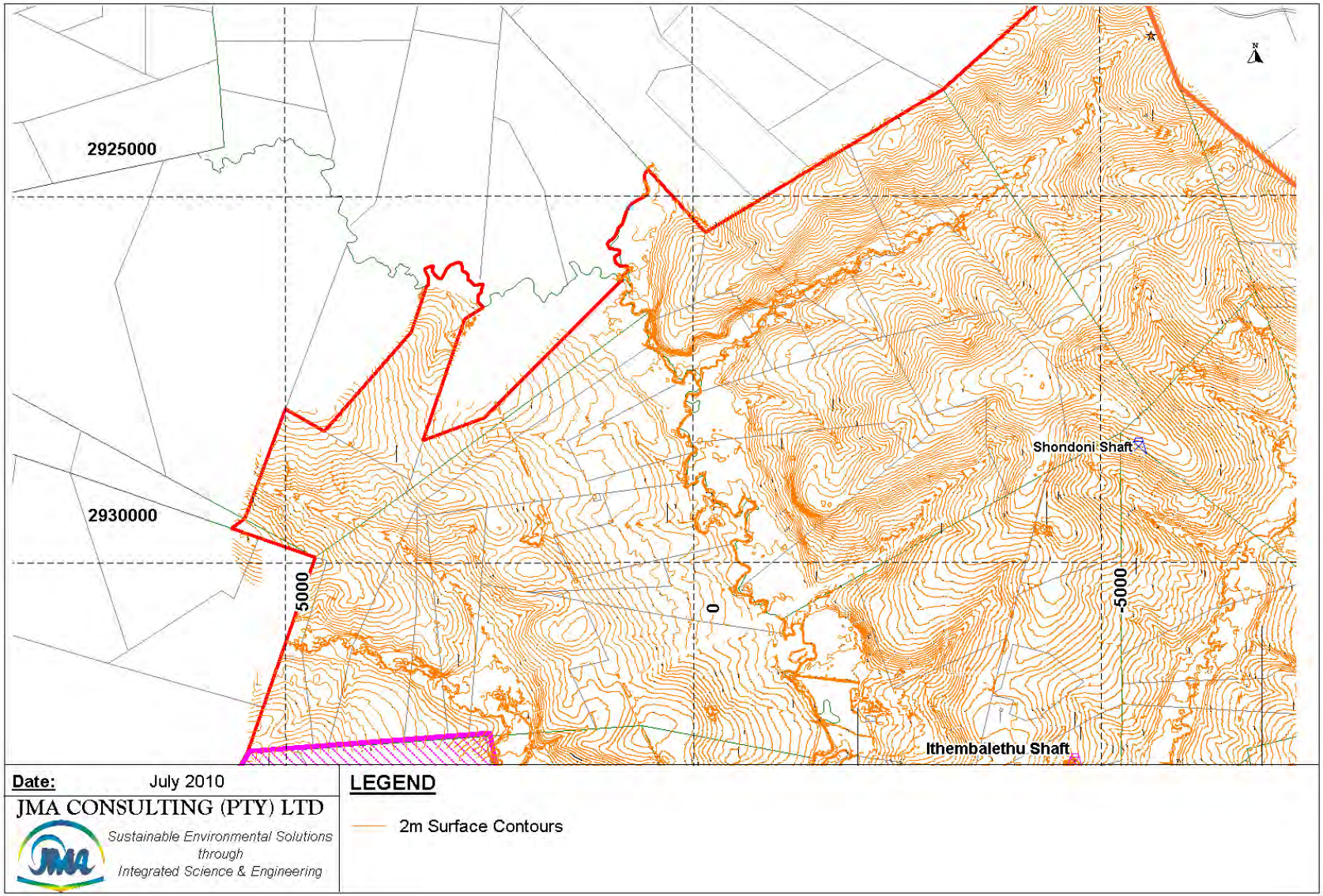


Figure 5.2.2(a): Detailed (2 m resolution) Surface Topographical Shaded Relief Map for North Western Quadrant

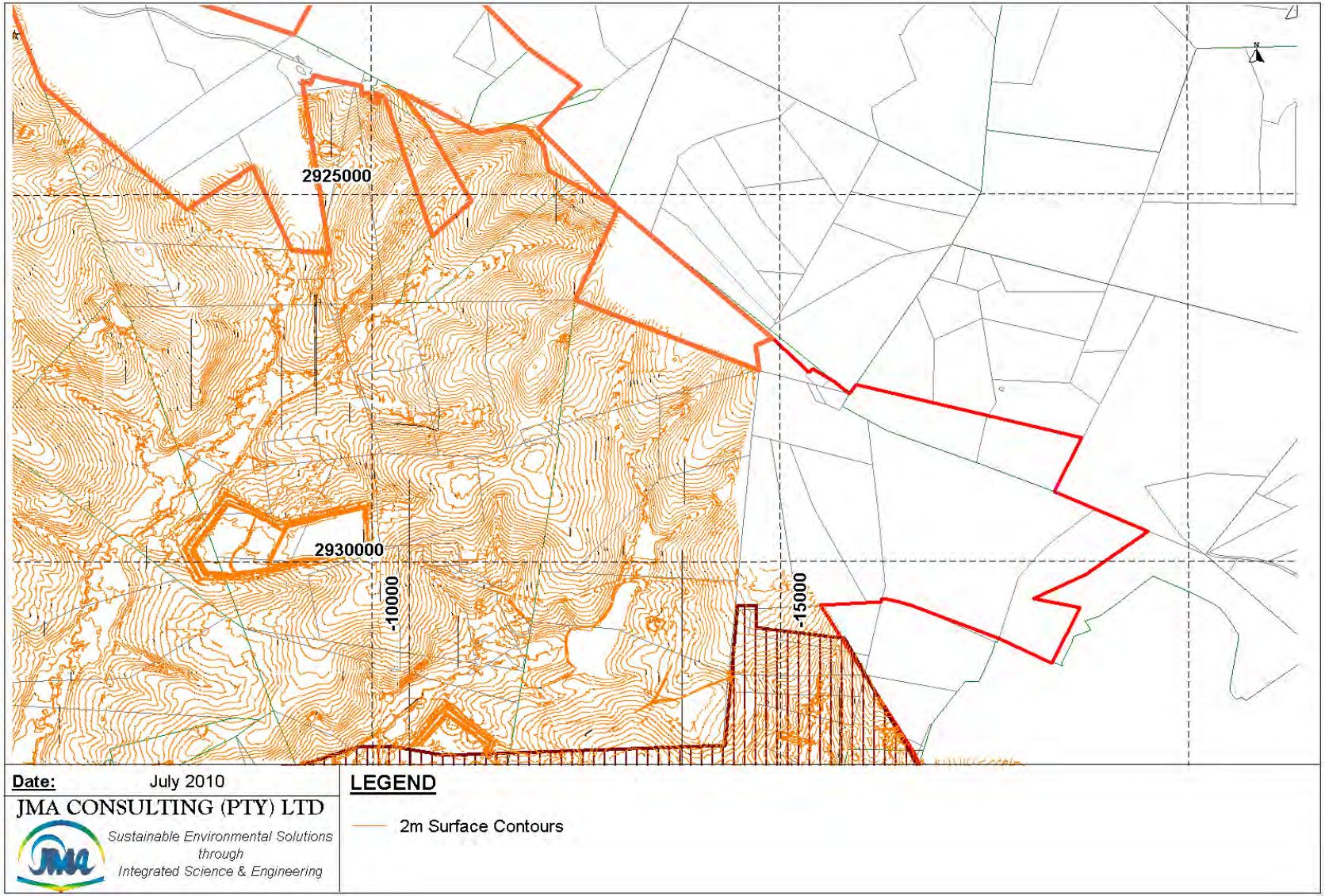


Figure 5.2.2(b): Detailed (2 m resolution) Surface Topographical Shaded Relief Map for North Eastern Quadrant

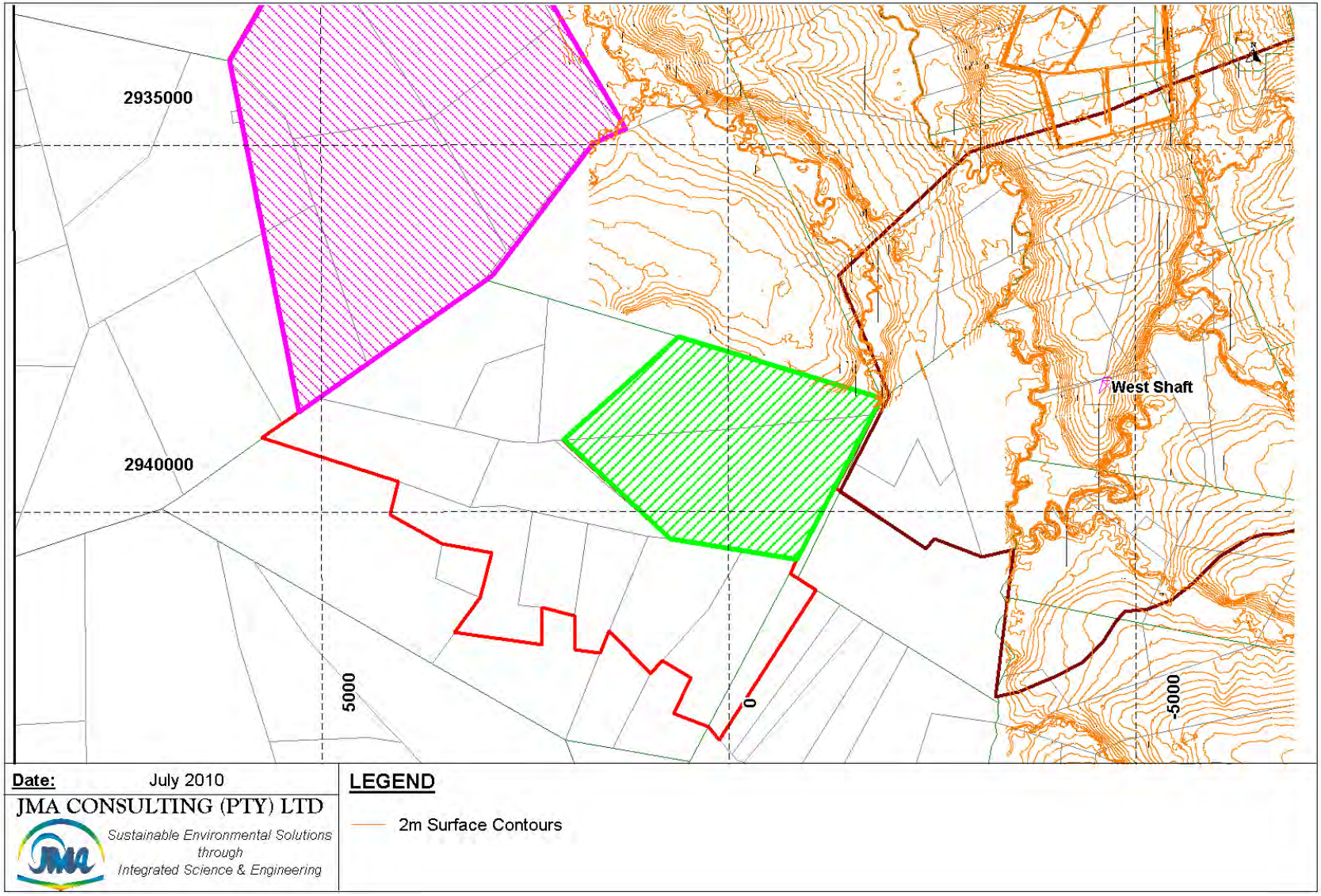


Figure 5.2.2(c): Detailed (2 m resolution) Surface Topographical Shaded Relief Map for South Western Quadrant

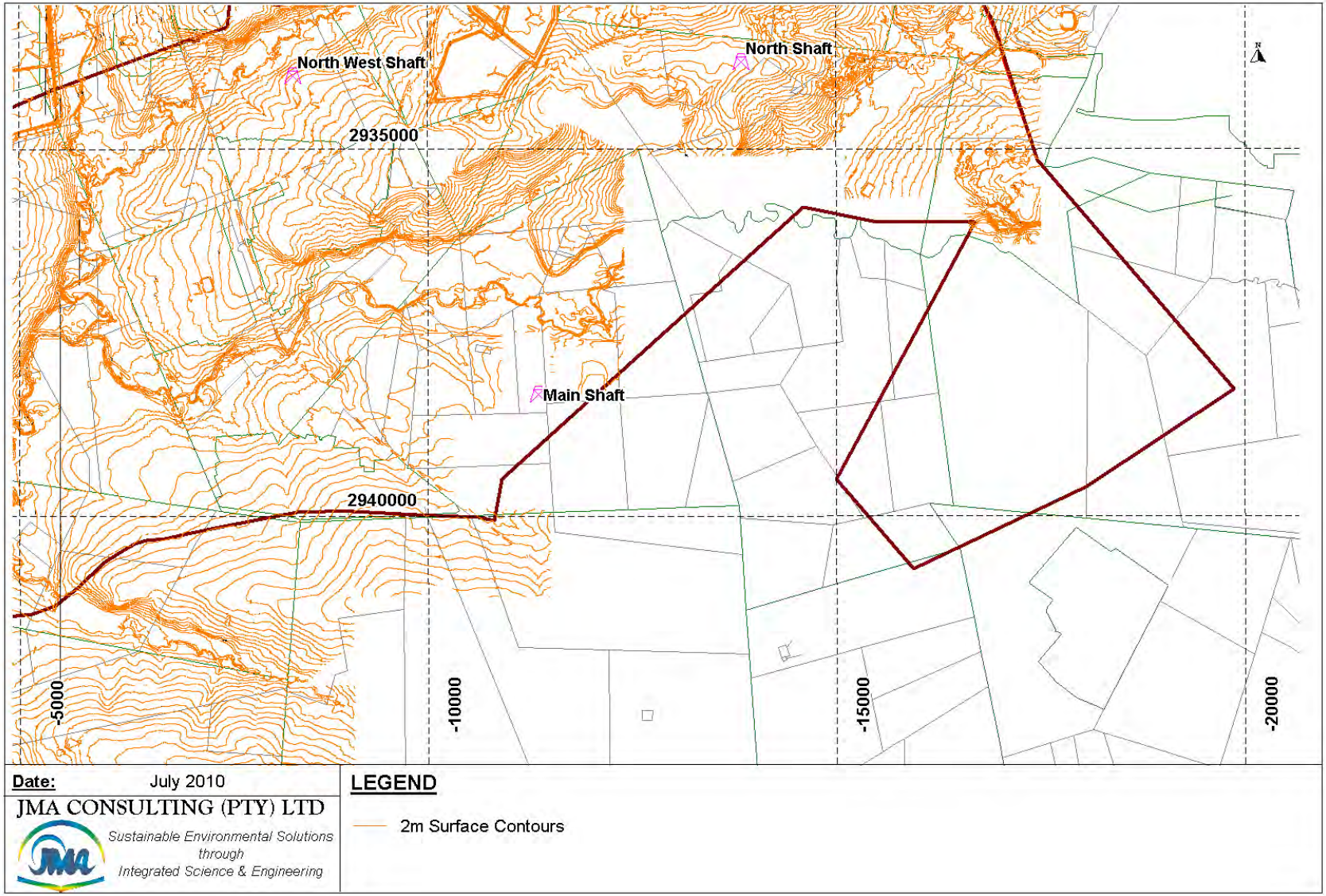


Figure 5.2.2(d): Detailed (2 m resolution) Surface Topographical Shaded Relief Map for South Eastern Quadrant

5.3 SOILS

J.M. A . C onsulting (Pty) Ltd c ommissioned E arth S cience S olutions (Pty) Ltd (ESS) to undertake the specialist Soils (Pedological) baseline studies for the areas that are to be disturbed by the proposed/planned SASOL Middelbult – Block 8 – Shonodoni E xpansion Project. T he pr oject a ims t o e xpand t he existing underground m ining a nd i ts associated s upport i nfrastructure within the e xsiting Middelbult - Block 8 r eserves but a lso a dding t hree ne w reserve bl ocks na mely Springbokdraai Reserves, Leeuwpan Reserves and Block 8 Northern Reserves.

An initial s ite e valuation was unde rtaken during May and J une of 20 10, t he Scoping Study of the area of concern having been compiled by J.M.A Consulting in A pril 2010. S ubsequent i nvestigations a nd s tudies a round t he m ine pl anning have c ulminated in the detailed specialist inve stigations be ing c ommissioned a s part of this phase of the mining right application process.

The ESS s tudy involved t he undertaking of a r econnaissance pe dological s urvey and l and c apability s tudy as pa rt o f t he greater EMPR a mendment, t he studies being unde rtaken s o as t o s atisfying t he r equirements of t he National Environmental M anagement A ct (NEMA) as w ell a s the M ineral a nd P etroleum Resource D evelopment A ct (MRPDA), w ith t he unde rlying a ssurance t hat t he studies w ould m eet t he best pr actise m ethodology a nd s tandards o f t he Equator Principles. T o this end, a number of soil parameters were mapped, recorded and interpreted.

A t otal a rea of approximately 4,600 h a ha s b een i nvestigated i n t he course of current the s oils a nd l and c apability s tudies u ndertaken. T he e ntire Block 8 reserve has been investigated in detail during a previous investigation by ESS.

The s oils de scription pr ovided de als w ith t he overall Block 8 and a dditional reserve a reas, f or w hich underground m ining (Total E xtraction a nd Bord a nd Pillar methods) is planned, as well as with the development of the required surface infrastructure i nclusive of t he ha ulage ways, a ccess roads, s oil and s oft overburden stockpiles, ROM Stockpiles and the conveyancing of the raw product to the beneficiation area.

The l and pr oposed f or t he e xpansion t o t he exsiting M iddelbult – Block 8 operations, is ex isting f armland that ha s be en zoned as s uch and i s already disturbed by these activities. The proposed linear features (conveyer lines, haulage ways, pipelines and electrical reticulation will traverse a number of differing land and soil types, with the majority of the length of the features being planned over existing a gricultural l and (arable and grazing), w hile the s oil s tockpiles a nd materials handling facilities are generally associated with farmlands that are being utilized for either livestock grazing or associated agriculture.

Mining and the development of support infrastructure is a feature of the landscape in the vicinity, and mining as an activity in the Kinross – Trichardt area has been accepted as a way of l ife f or generations a nd has coe xisted with farming successfully t o date. However, w ith t he e ver-increasing competition f or land, i t has be come impe rative that the f ull s cientific f acts f or a ny p articular site a re known, a nd t he e ffects on t he l and t o be us ed by any ot her pr oposed e nterprise must be evaluated, prior to the new activity being implemented (NEMA).

5.3.1 Methodology and Approach

5.3.1.1 Data Collection

Review of Published Reports and Maps

The area proposed for development is in close proximity to a number of existing mining ventures, and forms part of the greater coal mining regions of the eastern and central highveld coal fields of South Africa. Extensive geological and geotechnical information is available for this area and a substantial amount of existing socio economic and environmental work has been undertaken. The geology and geochemistry of the sedimentary formations that make up the major portion of the materials that are to be affected by mining or infrastructure development are well known and understood. SASOL Coal has undertaken detailed economic and geological/geotechnical investigations over the area of prospect, and has a proven resource that underlies the area.

With the economic viability of the resource understood, and with a mine plan on the table, it remains only for the socio economic and environmental aspects of the site to be assessed and the impacts understood. The general characteristics of the soils of this area are well understood. However, the subtle changes and localised changes in characteristics is important baseline information required if sustainability of rehabilitation and closure are to be achieved, and if a realistic management plan for the soils and land capability are to be achieved during the operational phase. These detailed specialist investigations will add to the baseline information required as part of the planning, operational and rehabilitation phases that are proposed for the Middlebult - Block 8 - Shondoni Project.

In addition, ESS have used any exploration data, drilling logs where available and the reconnaissance scoping report to better understand the basic characteristics of the soils and the lay of the land, to obtain information about the parent geology that has contributed to the soil formation that cover the area of study and to extrapolate chemical and physical attributes to the soil classification. The Land Type Mapping of S.A. (1:250000 scale), the Geological Map of S.A. and local knowledge of the soils and land capability where made available to the study. However, no existing detailed mapping was available.

The Department of Agriculture is concerned, and has voiced its concerns regarding the impact of further mining activities on the agricultural potential of the soils in the South Africa in general, and this region in particular. The Land Type Maps are the only information that could be supplied by this department however. In addition, significant comment and concerns were received from the local communities.

The maps available during scoping were of a small scale, and have been compiled using basic aerial photographic interpretation of the area with limited field interpretation. They are a good first approximation, and in combination with the geological maps (1:250,000) were useful as a baseline from which to work.

Of significance to the study is the underlying geology, with a moderately complex suite of rocks that make up the sequence. In its simplicity, the major portion of the

area studied is underlain by the Ecca sediments that have been intruded by a complex of younger dykes and sills of differing ages and orientation.

It is these complexes of lithologies combined with the topography that produce the complex of differing soil polygons noted across the study site.

Field Work

The pedological study of the Middlebult – Block 8 - Shondoni site was performed based on a variable grid bases with the understanding that surface features will affect the surface to a greater degree than the underground mining (Bord and Pillar), and required a detailed assessment, while balance of the area (underground mining) was covered on a reconnaissance grid base.

The soil classification/characterisation and mapping has delineated the broad soil patters for the total mining right area. The survey was undertaken during May and June of 2010. In addition to the grid point observations, a representative selection of the soil Forms mapped was sampled to determine the chemistry and physical attributes of the soils. The soil mapping was undertaken on a 1: 10,000 scale (Refer to Figure 5.3.1 .1(a), Figure 5.3.1.1(b), Figure 5.3.1.1(c) and Figure 5.3.1.1(d) – Soil Polygon Mapping) .

A total area of approximately 4,600ha was covered in the course of this study.

The majority of observations used to classify the soils were made using a hand operated Bucket Auger and Dutch (clay) augers with any and all natural exposures (road cuttings etc.) being used to obtain a better understanding of the in-situ characteristics of the soils. Where possible, and if the characterisation of the soils required, an observation pit was dug so as to obtain better information. However, due to the limited time available for these studies, only a limited number of observation pits were dug.

In all cases, the observation points were excavated to a depth of 1,500mm or until refusal was obtained. Immediately after completing the classification of the profiles, the excavations (Pits and Auger Holes) were backfilled for safety reasons.

Standard mapping procedures and field equipment were used throughout the survey. Initially, geological map of scale 1:250,000 and top cadastral maps at a scale of 1: 50,000 were used to provide an overview of the area, while Ortho photographs at a scale of 1:10,000 being used as the base map for the soil survey.

The fieldwork comprised a site visit during which profiles of the soil were examined and observations made of the differing soil extremes. Relevant information relating to the climate, geology, wetlands and terrain morphology were also considered at this stage. This information was obtained from the client or from other consultants involved in these areas of speciality.

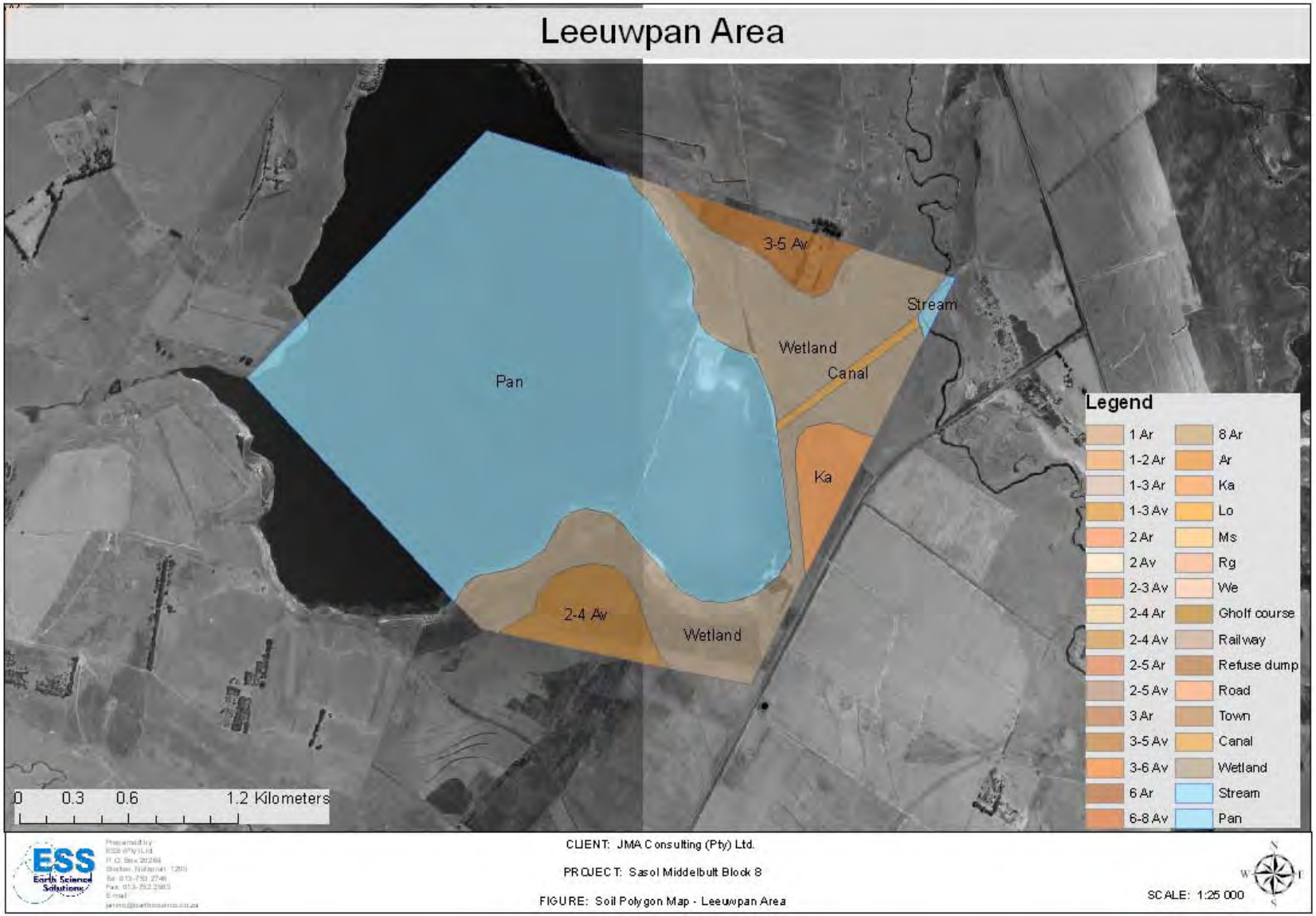


Figure 5.3.1.1(a): Soil Polygon Map – Leeuwpan Reserves

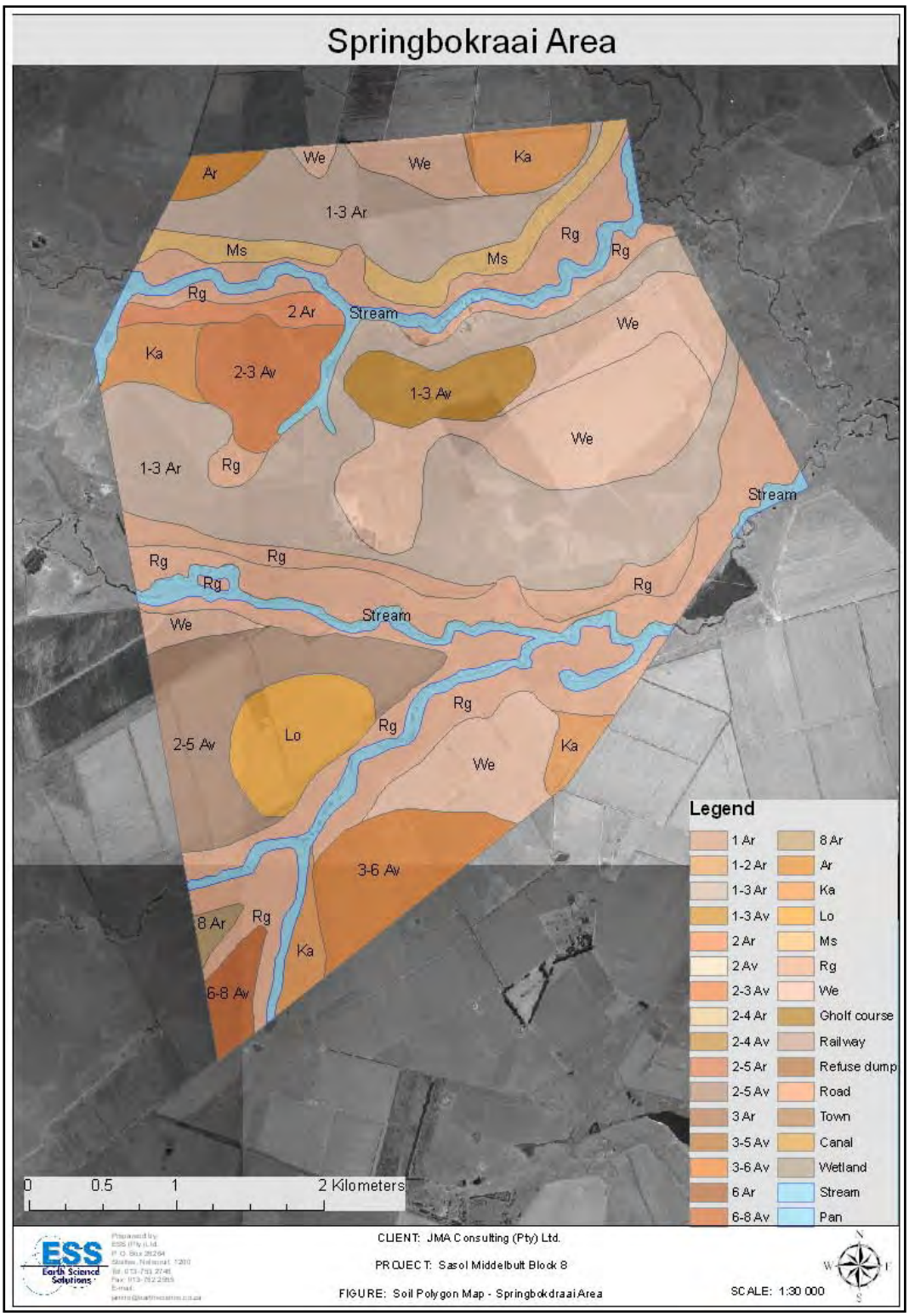


Figure 5.3.1.1(b): Soil Polygon Map – Springbokdraai Reserves

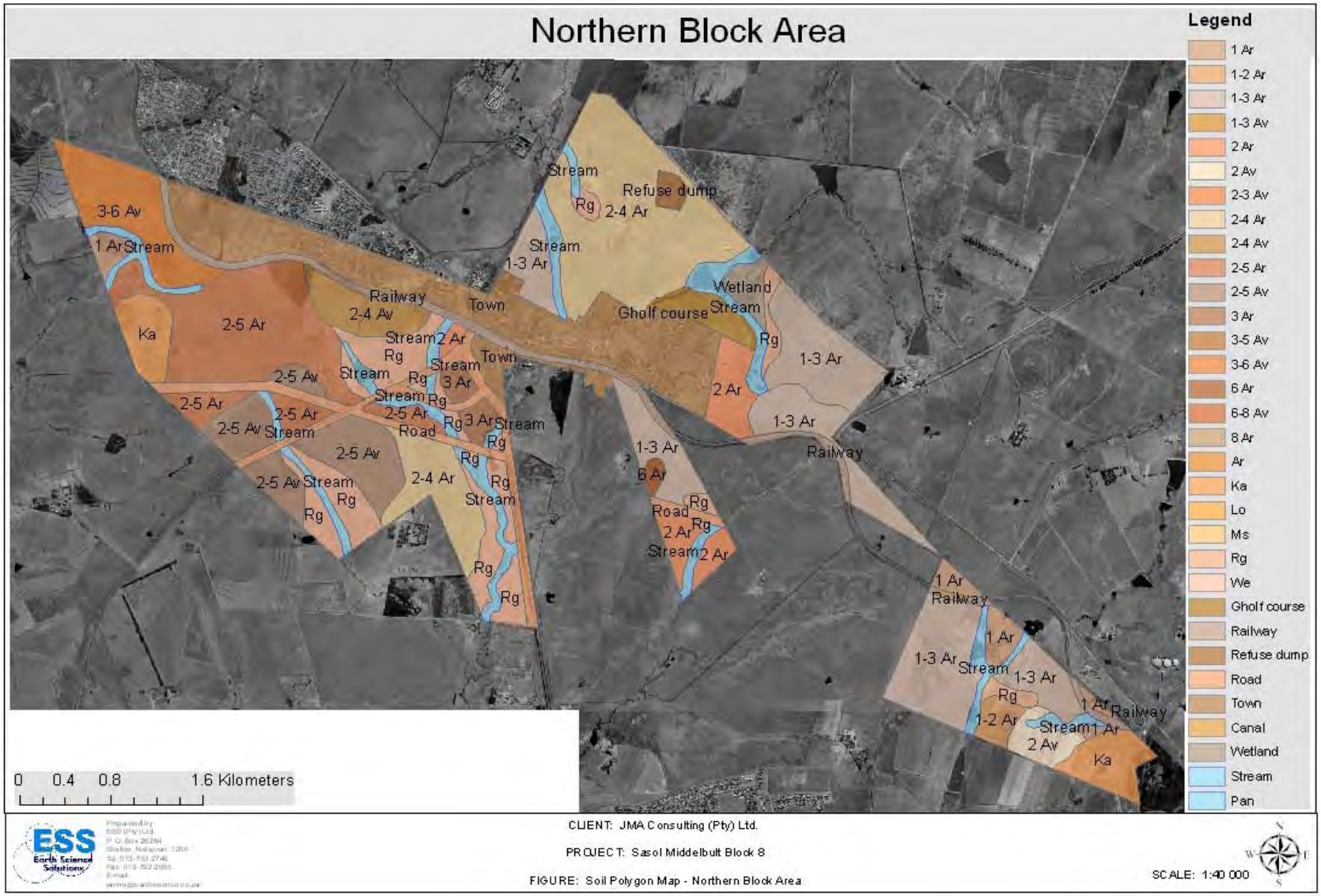


Figure 5.3.1.1(c): Soil Polygon Map – Block 8 – Northern Reserves

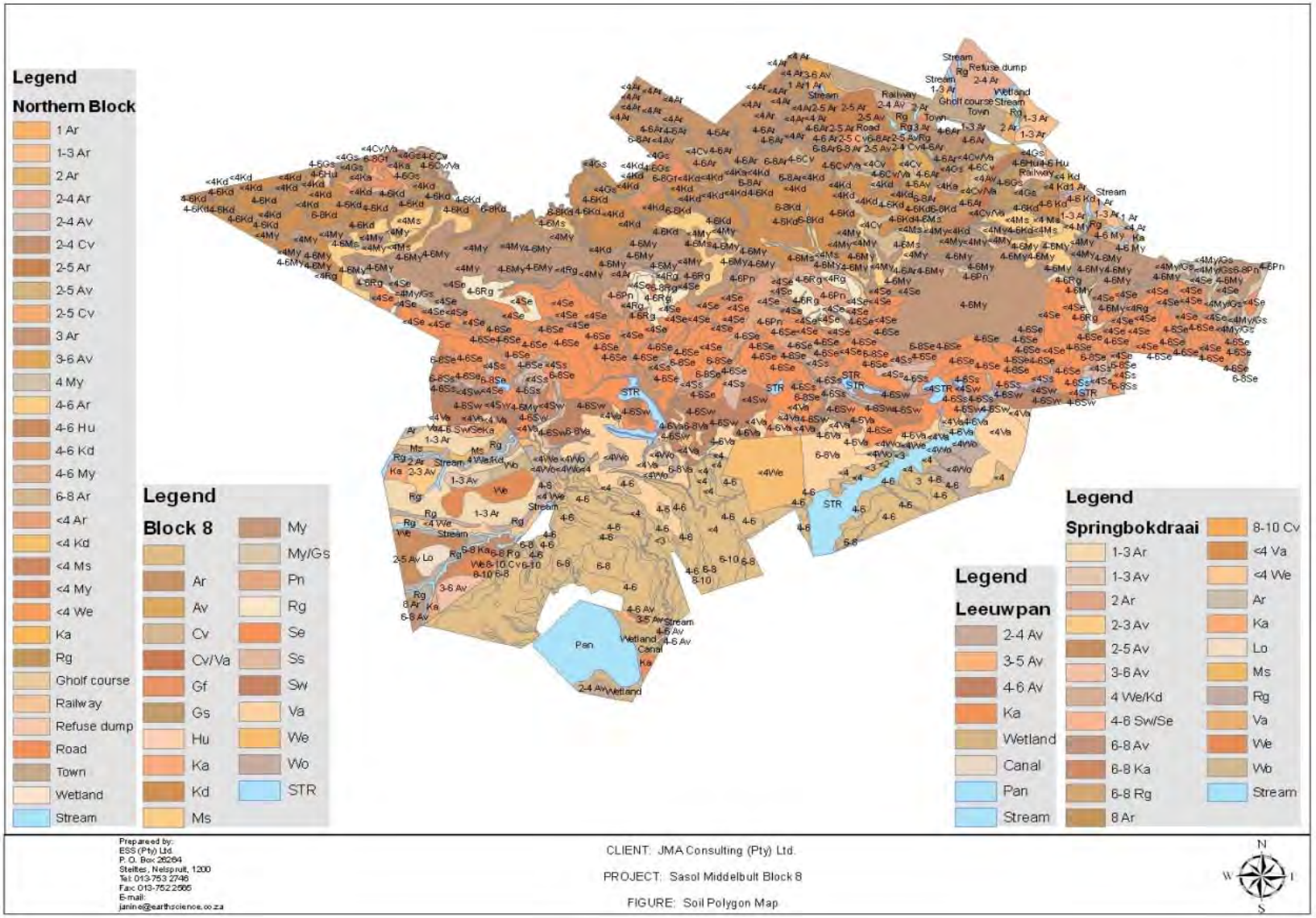


Figure 5.3.1.1(d): Soil Polygon Map – Entire Block 8 – Shondoni Reserves

The pedological study was aimed at investigating/logging and classifying the soil profiles. Terrain information, topography and any other infield data of significance was also recorded, with the objective of identifying and classifying the area in terms of:

- The soil types to be disturbed/rehabilitated;
- The soil physical and chemical properties;
- The soil depth;
- The erodibility of the soils;
- Pre-construction soil utilisation potential, and
- The soil nutrient status.

5.3.1.2 Soil Profile Identification and Description Procedure

The identification and classification of soil profiles were carried out using the *Taxonomic Soil Classification System (Mac Vicar et al, 2nd edition 1991*)

The Taxonomic Soil Classification System is in essence a very simple system that employs two main categories or levels of classes, an upper level or general level containing Soil Forms, and a lower, more specific level containing Soil Families.

Each of the soil Forms in the classification is a class at the upper level, defined by a unique vertical sequence of diagnostic horizons and materials. All Forms are subdivided into two or more families, which have in common the properties of the Form, but are differentiated within the Form on the basis of their defined properties.

In this way, standardised soil identification and communication is allowed by use of the names and numbers given to both Form and Family.

The procedure adopted in field when classifying the soil profiles is as follows:

i. Demarcate master horizons (Refer to Table 5.3.1.2(a))
ii. Identify applicable diagnostic horizons by visually noting the physical properties such as:
    - Depth (below surface)
    - Texture (Grain size, roundness etc.)
    - Structure (Controlling clay types)
    - Mottling (Alterations due to continued exposure to wetness)
    - Visible pores (Spacing and packing of peds)
    - Concretions (cohesion of minerals and/or peds)
    - Compaction (from surface)
iii. Determine from i) and ii) the appropriate Soil Form
iv. Establishing provisionally the most likely Soil Family

Sampling of representative areas of each of the Soil Forms were carried out and submitted for analysis.

Factors that were considered in the laboratory included:

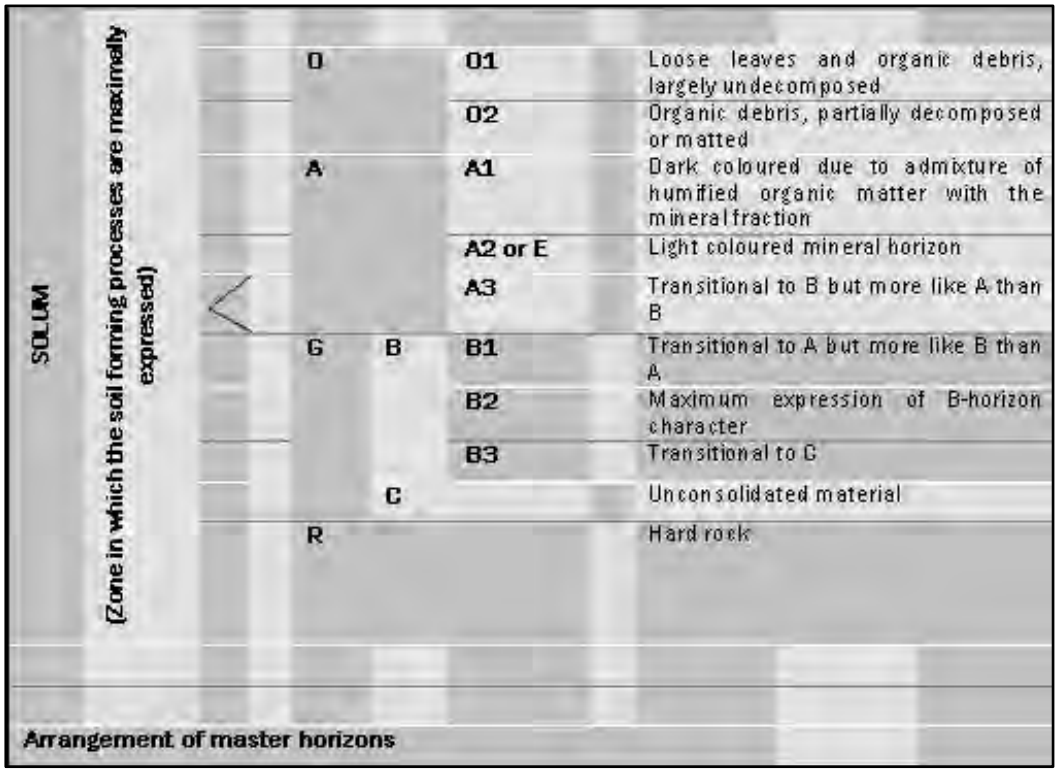
- Determination of the pH
- Exchangeable bases
- C.E.C. (cation exchange capacity)
- Texture (% clay)
- Nutrient status and
- Any potential pollutants

The methods employed in the determination of the above variables are:

- The Spectro Atomic Analyser for the determination of the basic elements
- The titration method for the determination of Organic Carbon contents, and
- The use of a density meter for the determination of the clay contents.

Analytical results are given for the extractable quantities available from the soil, the results having been obtained from the actual soil sample.

Table 5.3.1.2(a): Typical Arrangement of Master Horizons in Soil Profile



5.3.2 Soil Description

5.3.2.1 Soil Forms Identified

The "major" soil types mapped during the most recent (June 2010) site assessment comprise shallow structured and wet based soils that include the Avalon, Westleigh, Longlands, Katspruit and Rensburg Forms, with significantly large areas of Arcadia Form soils in the Northern Block. Of the total area included in the SASOL Middelbult - Block 8 – Shondoni study area are a number of other soil forms. The major forms mapped across the study site include those of the orthic phase Hutton, Clovelly, Griffin, Shortlands of varying depth, with areas of shallow Mispah, Mayo and Glenrosa Form soils which cover small but significant portions of the study area, while minor and less significant areas of structured materials occur associated with the much younger and basic dolerite and in places diabase intrusives.

The hydromorphic form soils are extremely prevalent and of significance to the EIA, the generally slight topographic slope and resulting wide expansive drainage lines that characterise the study area resulting in proportionately large areas of transition zone wetland and wet based soils. These areas comprise a large variety of soils, varying from deep transition zone Glencoe, Avalon, Pinedene, Bainsvlei and Bloemdal forms to the more shallow wetland soils including the sandy loams and sandy clay loams in the form of the Westleigh, Longlands, Avalon and Dresden forms, and the more structured to highly structured Willowbrook, Sepane, Kroonstad, Katspruit and Rensburg forms, with areas of Arcadia.

The hydromorphic soils are primarily associated with the riverine areas and its tributaries, the terrace slopes and change in topography holding a strong correlation to the change is soil types. The horizontal bedding of the sedimentary lithologies that underlie a significant portion of the site and the presence of significant hard sandstone partings have resulted in large areas of hard plinthic horizons both in the lower lying drainage ways and wetland areas, as well as relic land forms at lower midslope and even midslope positions in the topography.

The various catena described for this area reflect the strong erosion environment on the crest and upper slopes, with large open floodplain deposits associated with the riverine environment, the distinctive soils associated with colluvial deposition, and variations on cumulative environments in between. These catena are tempered and altered by the complex lithological associations and geological formations that make up the sedimentary pile and its intrusives with which the coal deposits are associated. It is this complex of interactions combined with the complex of topography, climate and geomorphology that complicate the soil pedogenisis and that result in the complex of soil forms mapped.

All relevant soils and related spatial information (inclusive of waterways) in the study area has been captured in a GIS format with the land capability having been ranked/rated according to a combination of the Chamber of Mines Land Capability Rating System and the Canadian Land Inventory System.

The utilization of the soil classification information and related geomorphological characteristics has been combined with the local climatic information in obtaining a reliable rating for the land capability potential.

The spatial distribution and size of the different soil types has been captured in a soil map and tabled as a percentage of the total study area. Please refer to Table 5.3.2.1(a) to 5.3.2.1(d) for the soil areas, and to Figure 5.3.1.1(a) to 5.3.1.1(d) for the maps (Soil Polygon Maps).

A short description of the major soil forms that have been characterised and mapped during the expansion study are given below, with the salient features of each soil being discussed in some detail. Of significance to the outcomes from these studies is the significant physical and chemical attributes of each soil form. These are important in understanding how the different soils will react to being disturbed, handled and stored (stockpiled), and will have a bearing on the ease or difficulty of handling of the soils at the time of stripping, hauling and/or rehabilitation. The management plan and resultant ease of mitigation of impacts are dependent on the knowledge of these soil properties.

Table 5.3.2.1(d) reflects the combined studies for the complete Block 8 – Shondoni Project area.

Table 5.3.2.1(a): Soil Coverage – Leeuwpan

Leeuwpan Soil Polygon Table					
Soil Code	Soil Name	Soil Depth	Comment	Area (Ha)	% of Area
2-4 Av	Avalon	2-4	(We) 15-20% Clay	28.12	3.94%
3-5 Av	Avalon	3-5	20-25% Clay	20.40	2.86%
Canal	Canal			4.86	0.68%
Ka	Katspruit		(We) 40-60% Clay, Soil Sample	19.24	2.69%
Pan	Pan			475.37	66.58%
Stream	Stream			2.62	0.37%
Wetland	Wetland			163.40	22.88%
			Total Area (Ha)	714.02	100.00%

Table 5.3.2.1(b): Soil Coverage – Springbokdraai

Springbokdraai Soil Polygon Table					
Soil Code	Soil Name	Soil Depth	Comment	Area (Ha)	% of Area
1-3 Ar	Arcadia	1-3		453.98	23.96%
1-3 Av	Avalon	1-3	(We) 15-20% Clay	49.04	2.59%
2 Ar	Arcadia	2		22.71	1.20%
2-3 Av	Avalon	2-3	(We) 15-20% Clay	58.19	3.07%
2-5 Av	Avalon	2-5	(We) 20-25% Clay	119.59	6.31%
3-6 Av	Avalon	3-6	(We/Lo) 25-30% Clay	76.82	4.05%
6-8 Av	Avalon	6-8		21.25	1.12%
8 Ar	Arcadia	8		6.93	0.37%
Ar	Arcadia		Ms	12.73	0.67%
Ka	Katspruit		We	86.66	4.57%
Lo	Longlands		(Ka) 20-25% Clay	63.14	3.33%
Ms	Mispah		Ar 1	52.38	2.76%
Rg	Rensburg			430.28	22.71%
We	Westleigh			312.19	16.47%
Stream	Stream			129.13	6.81%
			Total Area (Ha)	1895.02	100.00%

Table 5.3.2.1(c): Soil Coverage – Block 8 Northern Block

Northern Block Soil Table					
Soil Code	Comment	Soil Name	Soil Depth	Area (Ha)	% of Area
1 Ar		Arcadia	1	34.82	1.99%
1-2 Ar	Ms	Arcadia	1-2	13.14	0.75%
1-3 Ar		Arcadia	1-3	341.20	19.51%
2-4 Ar		Arcadia	2-4	242.83	13.88%
2-4 Av	20-25% Clay	Avalon	2-4	35.59	2.04%
2-5 Ar		Arcadia	2-5	177.18	10.13%
2-5 Av		Avalon	2-5	88.06	5.04%
3 Ar		Arcadia	3	17.66	1.01%
3-6 Av	(We) (Lo) 10-15% Clay	Avalon	3-6	72.57	4.15%
6 Ar		Arcadia	6	4.78	0.27%
Ka		Katspruit		61.40	3.51%
Rg		Rensburg		140.69	8.04%
Stream		Stream		112.51	6.43%
Wetland		Wetland		14.77	0.84%
Town		Town		234.79	13.42%
Road		Road		75.69	4.33%
Railway		Railway		52.28	2.99%
Gholf course		Gholf course		21.56	1.23%
Refuse dump		Refuse dump		7.44	0.43%
			Total Area (Ha)	1748.95	100.00%

Table 5.3.2.1(d): Soil Coverage – Block 8 – Shondoni

Soil Form	Soil Depth (cm)	Soil Area (Ha)	% of Total Area (Ha)
Willowbrook (Wo)	<40	182.90	0.91
Valsrivier/Swartland (Va/Sw)	<40	73.90	0.37
Valsrivier (Va)	80-100	189.80	0.94
Valsrivier (Va)	60-80	446.10	2.21
Valsrivier (Va)	40-60	820.70	4.07
Swartland (Sw)	40-60	886.80	4.40
Swartland (Sw)	80-100	8.20	0.04
Swartland (Sw)	60-80	669.40	3.32
Sterkspruit (Ss)	60-80	111.60	0.55
Sterkspruit (Ss)	40-60	1,783.50	8.85
Sepane (Se)	60-80	201.30	1.00
Sepane (Se)	40-60	1,867.70	9.27
Sepane (Se)	<40	658.30	3.27
Rensburg (Rg)	40-60	456.20	2.26
Rensburg (Rg)	<40	293.60	1.46
Pinedene (Pn)	<80	7.10	0.03
Mayo (My)	40-60	556.90	2.76
Mayo (My)	<40	1,056.20	5.24
Mispah (Ms)	<40	226.70	1.13
Kroonstad (Kd)	40-60	44.50	0.22
Kroonstad (Kd)	<40	2,130.30	10.57
Katspruit (Ka)	<40	198.30	0.98
Hutton (Hu)	60-80	148.20	0.74
Glenrosa (Gs)	40-60	61.10	0.30
Glenrosa (Gs)	<40	35.60	0.18
Griffin (Gf)	80-100	4.70	0.03
Griffin (Gf)	60-80	139.00	0.69
Clovelly (Cv)	80-100	10.80	0.05
Clovelly (Cv)/Valsrivier (Va)	60-80	271.30	1.36
Clovelly (Cv)	80-100	6.40	0.03
Clovelly (Cv)	40-60	9.10	0.06
Avalon (Av)/Westleigh (We)	<40	10.70	0.06
Avalon (Av)	60-80	16.10	0.08
Arcadia (Ar)	60-80	177.00	0.88
Arcadia (Ar)	40-60	3,904.30	19.38
Arcadia (Ar)	<40	37.00	0.18
Disturbed Areas		299.00	1.48
Oos		1,040.50	5.17
Streams		1,002.10	4.98
Water		99.50	0.50
Total Area		**20,142.40**	**100.00**

Hutton (Hu)

The Hutton Form soils mapped in the area comprise predominantly fine grained sandy, to silty loams or fine to medium grained sandy clay loams (depending on the lithological unit from which they are derived), and generally exhibit an apedel to single grained structure. These soils generally returned pale red/brown to orange/red colours in the topsoil's, and fine to medium grained sandy clay and clay loams, with dark orange reds and dark red colours in the subsoil horizons.

Clay contents vary from as low as 10% and 15% in the sandy topsoil's of the soils derived from the sediments, rising as high as 25% in some instances where the soils are associated with more basic lithologies.

In the topographically lower lying areas, the high clay contents are associated with the fine to very fine grained colluvial derived materials.

The subsoil clay percentages range from about 15% to 45% depending on the position that they occupy in the topographic sequence and the host geology from which they are derived.

In almost all cases mapped, the soils classify as having a mesotrophic leaching status (moderately leached) and are luvic in character. This implies that the soils are only moderately leached. These soil forms generally occupy the upper and upper midslopes, and returned effective rooting depths (ERD) that vary from as shallow as 400mm to greater than 1,200mm.

Chemically, these soils are of the more productive soil forms in the area. However, the chemical analysis undertaken on the composite samples returned only moderate reserves of Ca and Mg, with lower than required reserves of P, Zn and K. Supplements of these nutrients will be needed if the soils are to be utilized for anything other than natural low intensity grazing of livestock. Additions of fertilizers are required if economically sustainable farming is to be undertaken on a long-term and sustainable basis.

Clovelly (Cv) and Griffin (Gf)

Soils of the Clovelly and Griffin Form have very similar characteristics to the Hutton Form described above and are generally derived from the same parent materials. The major differences are observed is the degree of leaching that has occurred. These soils returned physical and chemical characteristics very similar to the Hutton described, varying in physical characteristics from a very fine to medium grained sandy and/or silty loam, with pale grey brown to yellow brown colours and a single grained or thick topsoil ("A" horizon), on a yellow to yellow/red dystrophic "B", to those with a more clay rich sandy clay loam, displaying much darker yellow reds and less leached colours. These soils exhibit a predominantly mesotrophic leaching status and luvic characteristics.

Generally, these soils were noted to interface directly on a hard rock contact with only a thin saprolitic layer. This phenomenon is due mainly to the horizontal or sub horizontal bedding of the parent material from which they are derived.

These sandy to-sandy-clay loams are confined predominantly to the midslope and upper m idslope pos itions a nd o ften exhibit a t hin pl ough pa n l ayer at approximately 300m m, a n i ndication of t he depth t o w hich t he s oils ha ve previously b een compacted or w orked (ploughed). T he e ffective r ooting de pths vary f rom as l ittle a s 400m m t o 900m m i n pl aces w here t hey are i nhibited b y physical or chemical barriers.

Compaction and erosion are physical hazards to be aware of and catered for when working with these soil types. Chemically, these soils returned results similar to the Hutton soils described above.

Swartland (Sw) and Sterkspruit (Ss)

The S wartland Form a long w ith its mor e extreme ve rsion – the S terkspruit - is defined b y an or thic "A" hor izon on a p edocutanic B , o r a n o rthic "A" on a prismacutanic "B" respectively. T he s tructure o f t he "B" hor izon i s t he de fining feature between these soils Forms, the Sterkspruit having a stronger structure than the Swartland.

These soils are widespread over the mid and upper midslope positions where the soils ar e as sociated with the m ore b asic pa rent hos t m aterial (Dolerite and/ or Diabase) or on the scree slopes below the dolerite dykes that were encountered in the southern portions of the area mapped.

Clay percentages range from 20% to 28% in the topsoils, and between 35% and 65% i n t he s ubsoils. These s oils r eturned m oderate t o g ood w ater hol ding capabilities due t o t he h igh c lay c ontents. H owever, not a ll of t his m oisture i s available to the plant as the two to one swelling nature of the clays has a strong electrical bond on the water particles. Total Available Moisture (TAM) levels are thus l ower t han w ould otherwise b e e xpected. These s oils s how onl y moderate drainage characteristics and are moderately susceptible to salinity problems if not managed correctly. Drainage and surface water management are essential for good economic return of agriculture on these soils.

Both the Swartland and Sterkspruit forms are susceptible to compaction in the wet state, a nd e rosion i s a major pr oblem due t o t he di spersive n ature o f the s oil particles. Chemically, these soils are prone to solution weathering, the sodium and calcium be ing e asily ta ken into solution. These s oils w ill ne ed extremely good management, and protection during stockpiling as well as during the rehabilitation process.

Valsrivier (Va)

The Valsrivier Forms mapped can be divided into two categories, based on their colour a nd de gree o f s tructure. T hose w ith a p redominantly red c olour a re o n average less structured and can be grouped with the Hutton Form with regards to their land capability, irrigation potential and general workability. In contrast, the brown Valsrivier Form has a stronger structure verging on s trong blocky, and is more closely aligned to the Swartland Form soils in character.

Chemically, both soil families are very similar, returning moderate to good levels of most nutrients (Ca, Mg and K), the brown Valsrivier returning higher levels of Sodium (Na) (in the updated areas), r esulting i n a greater p otential f or salinity/sodicity problems in the brown soils than in the red.

Structurally the brown Valsrivier forms are more difficult to work, and they are generally shallower (400-600mm).

These soils are generally associated with the dolerite derived parent materials.

Better than average management of both erosion as well as compaction will be needed to retain the usability of these soils during the rehabilitation process.

Glenrosa (Gs) Dresden (Ds) and Mispah (Ms)

The Glenrosa, Dresden, and Mispah soil forms returned effective rooting depths of between 150mm and 400mm. The major constraint envisaged with these soils will be tillage, sub surface hindrance and erosion. The restrictive layer associated with these s oils is a ha rd lithocutanic la yer i n t he f orm of w eathered pa rent material (Gs), hard plinthite (Dr) or rock (Ms).

The effective soil depth is restricted, resulting in reduced soil volumes and as a result, depletion in the water holding capacity as well as nutrient availability.

Geophysical characteristics of these soils include moderate clay percentages (12% to 20%), moderate internal drainage and low water holding capabilities.

These materials are of the poorer land capability units mapped. It is imperative that good management of these soils is implemented, both from the erosion as well as the compaction perspective.

Glencoe (Gc)

The Glencoe soil form is generally confined to the lower mid-slope, lower slope and bottom land positions, and is found associated with the transition zone and wetland areas t hat ar e r egularly i nfluenced by the s oil w ater and regional groundwater table. These soil forms are indicative of a persistent wetting of the subsoil, and the formation of a hard plinthic horizon at the base of the profile. These s oils a re also associated with lithologies tha t a re rich in iron and magnesium.

These soils are characterised by a hard plinthic (ouklip) layer at the base of the profile, and are classified as wet soil types. It should be noted however that these soil for ms a re s ometimes f ound i n m id, a nd i n s ome c ases, upp er m idslope positions, as residual, or old land forms.

Physically these soils returned fine to medium grained, pale red to brown, apedel structure in the topsoil's ("A" horizon), with moderate to low clay contents (12% – 18%) and moderate to low water holding capabilities (40 – 60 mm/m).

The subsoil is generally pale yellow/red to pale red in colour, returning moderate clays (12% – 22%), fine to very fine-grained sand fractions, with a concretionary layer at the interface between the "B" horizon and the hard plinthic "C" horizon.

Chemically, the soils are similar to the Avalon, Pinedene and Westleigh soil Forms described herein.

Hazards to be managed on these soils include the impeded drainage caused by the hard plinthic layer, compaction in the wet state, and erosion.

Bainsvlei (Bv), Bloemdal (Bd), Pinedene (Pn) and Avalon (Av)

The Bloemdal and Pinedene form soils are found associated with the deeper profiled Bainsvlei and Avalon Forms that have been mapped as part of the transition zone terrace slopes that occur upslope of the wetland environ. These soils are characterised by hydromorphic features (soft plinthic – mottled horizons of varying intensity at depth ("C" horizon).

These soils are most often found associated with but upslope of the Westleigh and Kroonstad soils and comprise the major "hydromorphic" category of soil classified on the site, and are of the more sensitive materials that will potentially need to be worked and handled during the construction and rehabilitation phases. Better than average management of these materials will be needed.

Chemically, these soils (characteristics are similar within these same forms) are moderately well leached returning significantly lower amounts of Ca and Mg than the dryer soils, as well as depleted amounts of Na, K and P. The leaching of the nutrients from these soils is significant and the pale colours are evidence of the movement of water within the profile.

By definition, these soils vary in the degrees of wetness at the base of their profile, i.e. the soils are influenced by a rising and falling water table, hence the mottling within the lower portion of the profile and the pale background colours.

Depths of utilizable agricultural soil (to top of mottled horizon) vary from 400mm to over 700mm. The deeper rooting depths (>700mm) are considered potentially utilizable soils, with those less than 500mm being considered to have a wetland or wilderness/conservation status. In general, these soils are high in transported clay in the lower "B" horizon with highly leached topsoil's and pale denuded horizons at shallow depths. The nutrient status is variable, but due to excessive leaching is generally low.

These materials will be more difficult to work due to the wetness factor, both during the construction phase and operation, as well as on rehabilitation. Compaction is a problem to contend with if these soils are to be worked during the wet months of the year. Stockpiling of these soils should be done separately from the dry soils and greater care is needed with the management of erosion problems during storage. Any strong structure that develops during the stockpiling stage will need to be dealt with prior to the use of this material for rehabilitation.

Westleigh (We)

The Westleigh soil form is by definition a soil with strong hydromorphic characteristics. It exhibits strong indications of wetness at shallow depths in the form of strong red to yellow/red mottling on a grey (gleyed) background.

In general, these soils are high in transported clay in the lower "B" horizon with highly leached topsoil's and pale de nuded horizons at shallow depths. The nutrient status is generally low.

These soils will be more difficult to work due to the wetness factor, both during the construction and operation of the facility.

Compaction is a problem to contend with if these soils are to be worked during the wet months of the year.

Stockpiling of these soils should be done separately from the dry soils and greater care is needed with the management of erosion problems during storage.

Any strong structure that develops during the stockpiling stage will need to be dealt with prior to the use of this material for rehabilitation.

Kroonstad (Kd), and Katspruit (Ka)

The Kroonstad and Katspruit soil Forms are found associated exclusively with the wetland and vlei areas alongside the rivers and prominent pan features. The hydromorphic nature of these soils renders them highly susceptible to compaction and erosion.

Re-working of these soils for rehabilitation purposes will need to be undertaken during the dry months of the year, and will require that the structure is broken down if these soils are to be used for topdressing of areas prior to replanting.

Longlands (Lo)

The Longlands soil Form is found associated exclusively with the wetland and vlei areas within the floodplain environment and alongside the rivers and around the prominent pan features. The hydromorphic nature of these soils renders them highly susceptible to compaction and erosion.

Re-working of these soils for rehabilitation purposes will need to be undertaken during the dry months of the year, and will require that the structure is broken down if these soils are to be used for topdressing of areas prior to replanting.

Arcadia (Ar) and Rensburg (Rg)

The Rensburg and Arcadia soils are characterised by high clay contents, of a swelling variety (2:1 Swelling – Smectite clay) that produce strongly structured blocky and vertic fabric, are generally pale in colour (grey to grey brown), highly leached, and are, in almost all cases associated with the bottomland floodplain alluvial deposits, were accumulations of transported materials and soils make up the majority of the soil pedogenisis.

The vertic structure is the distinctive feature of the se s oils, the Arcadia by definition being a vertic horizon on soft rock base, while the Rensburg Form comprises a vertic "A" horizon on a gleyed G-horizon, with its distinctive greyish-yellow mottling due to direct contact with the water table. In the Arcadia Forms there are slight colour variations that differentiate the soil series' from one another, ranging from black to red.

Chemically, both soil Forms are very similar, returning moderate to poor levels of most nutrients (Al, P and N materialisation capacity). Conversely the salts (K and Zn) return a s higher levels, resulting in a greater potential for salinity and/or sodicity problems (moderate to severe).

Physically these soils have very high clay contents (> 40%) with moderate to high moisture holding capabilities. The intake rates range from moderate to poor with poor drainage characteristics and a high erosion hazard index.

Structurally both of these soil forms are difficult to work, the Arcadia often being associated with a shallow water table.

Better than average management of both erosion as well as compaction will be needed to retain the usability of these soils during the rehabilitation process.

5.3.2.2 Soil Chemical and Physical Characteristics

A suite of composite and representative samples from the differing soil forms/types were taken and sent for analyses for both chemical as well as physical constituents (Refer to Table 5.3. 2.2(a) (Latest Results) and 5. 3.2.2(b) (Previous/Original Mapping) for the results). A select number of samples were submitted, each sample containing a number of sub samples from a particular soil polygon/type which is representative of the area in question, thus forming a composite sample, which in turn is representative of the soil polygon rather than just the point sampled.

Soil Chemical Characteristics

Sampling of the soils for nutrient status was confined where possible to areas of uncultivated land. However, some of the land being used for grazing may have been fertilized in the past, and thus these results may not be truly representative of the soils in their natural state.

These results will be useful in understanding the pre mining/construction conditions, and will give a baseline from which to compare the soils at closure. However, due to the possible loss of nutrients from the soils during stockpiling and storage, additional sampling and analysis of the soils will be needed prior to their use for rehabilitation.

The results of the analysis returned moderate to light textured soils with a range of pH (KCl) values of between 3.8 and 7.5, a base status ranging from 2.0me% to 10.8me%, and nutrient levels reflecting generally acceptable concentrations of calcium and magnesium, but deficiencies in the levels of potassium, phosphorous and zinc, with predictably low organic carbon matter.

The structured and basic derived soils returned values that are indicative of the higher reserves of calcium and magnesium. They are inherently low in potassium reserves, and returned lower levels of zinc and phosphorous for economically acceptable agricultural growth.

The nutrient status indicates a need for fertiliser applications of “Zn” “P” and “K”.

It should be noted however, that the addition of “P”, “K” and “Zn” in the form of commercial fertilisers are potential pollutants to the riverine and groundwater environment if added in excess. This must be taken into account when applying these additives. Small amounts of fertilizer should be added on a regular/more frequent basis, rather than adding large quantities in one application.

Table 5.3.2.2(a): Soils Analytical Results (Current Shondoni) Study)

SASOL Middlebult (Shondoni) Block 8 Expansion																	
Sample No	Obs Pt	pH (Water)	Res (ohms)	Ca mg/kg	Mg mg/kg	K mg/kg	Na mg/kg	P (Bray1)	Al mg/kg	Ca/Mg	Ca+Mg/K	Zn mg/kg	C%	Org Mat%	Sand%	Silt%	Clay%
1548	Leeuwpan A	5.02	1400	1626	470	322	132	0.6	11	3.46	6.51	1.25	1.19	2.04	60	16	24
1549	Uitkyk A	5.65	2100	3089	1327	220	21	0.3	10	2.33	20.07	4.29	2.52	4.33	62	14	24
1550	SBD 2 A	5.93	840	3632	1473	217	171	0.5	9	2.47	23.53	3.52	1.01	1.73	60	6	34
1551	NP 1 A	4.96	500	537	149	225	8	10.7	51	3.60	3.05	2.92	1.01	1.73	82	4	14
1552	NP 1 B	5.33	990	734	373	107	61	0.3	15	1.97	10.35	1.25	0.86	1.49	68	12	20
1553	SBD 1 A	4.2	940	353	85	253	4	43.7	177	4.15	1.73	5.52	1.44	2.48	77	3	20
1554	SBD 1 B	5.08	890	986	284	104	5	0.5	16	3.47	12.21	1.44	0.5	0.87	60	10	30
1555	SB1	6.85	842	1946	728	12	20	7	1.2	2.67	222.83	1.10	0.33	NA	55	6	39
1556	SB2	4.7	622	122	34	12	3	7	6	3.59	13.00	0.90	0.04	NA	74	24	2
1557	SB3	7.55	1147	2775	215	4	10	7	0.8	12.91	747.50	1.20	0.32	NA	68	13	19
1558	SB4	7.2	1050	2060	733	11	23	8	0.1	2.81	253.91	2.00	0.26	NA	55	12	33
1559	SB5	4.75	985	134	33	12	9	8	4.4	4.06	13.92	1.50	0.10	NA	72	26	2

Table 5.3.2.2(b): Soils Analytical Results (Original Block 8 Study)

Determinants	Units	KS5	KS10	KS11	KS18	KS28	KS40	KS55	KS62	KS69	KS76	KS102	KS109	KS119	KS121	KS126	KS140	KS170	KS184	KS201	KS220
PH		0.25	5.8	4.9	6.8	6.65	6.9	5.85	5.75	3.8	5.6	5.15	5.55	5.85	4.95	6.55	7	5.2	6.48	7.8	7.15
Ca	mg/kg	200	3178	30	904	683	441	603	653	395	774	1446	1045	2806	893	2209	1489	1380	2156	3720	1345
Mg	mg/kg	60	1338	22	513	235	218	733	116	162	206	405	169	1273	289	1518	994	647	433	950	578
K	mg/kg	138	176	80	1090	631	69	25	178	111	130	208	296	161	257	145	81	208	216	89	68
Na	mg/kg	5	170	5	149	119	15	2	8	15	3	10	9	169	10	120	143	10	42	72	68
"S" Value (CEC)	me%	4.9	28.2	8.6	12.3	7.5	4.3	9.2	4.7	5.7	5.9	11.2	7.4	25.7	7.6	24.5	16.5	12.9	8.2	6.2	5.2
P	Amb.1mg/kg	117	12	123	170	150	7	6	10	13	5	7	19	3	5	2	5	5	2	3	5
Zn	mg/kg	2.7	0.5	2.7	4.9	3.3	12.2	24.3	1.4	4.4	0.9	0.7	1.6	0.4	0.4	1.5	1.1	2	2.2	11.8	3.2
Clay	%	20	57	22	18	15	9	12	24	23	30	21	30	46	20	24	6	24	26	25	22
Org Mat	C%	0.03	0.21	0.02	0.81	0.41	0.11	0.21	0.52	0.88	0.55	0.7	0.45	0.87	0.23	0.72	0.88	0.62	0.52	0.31	0.3

Determinants	Units	KS226	KS238	KS250	KS272	KS284	KS300	KS311	KS321	KS328	KS345	KS376	KS386	KS379	KS400	KS402	KS338	KS292	KS368
PH		7.53	7.8	6.48	7.04	5.83	6.69	7.46	6.03	8.2	7.09	7.32	8.24	7.81	6.76	7.06	6.2	6.92	7.35
Ca	mg/kg	1323	7660	2125	1361	1103	1641	3336	1568	6890	3409	1367	2858	1913	3003	1807	1297	1543	2680
Mg	mg/kg	413	567	433	430	377	514	1016	657	1050	1590	270	596	820	592	467	284	655	750
K	mg/kg	152	58	216	142	143	255	438	423	233	326	109	183	145	244	419	121	62	58
Na	mg/kg	68	95	42	204	34	33	210	80	109	111	8	4	50	1	43	66	70	39
"S" Value (CEC)	me%	3.8	7.5	8.8	5.9	1.9	5.6	10.3	7.8	5.3	9.3	1.7	3.2	2.7	3.1	5.9	2.5	6.3	4.1
P	Amb.1mg/kg	10	2	2	117	11	190	33	27	17	17	9	1	3	12	4	3	3	2
Zn	mg/kg	2.1	2	4.4	1.8	2.9	6.7	4.9	4.3	6.2	6.3	2.4	0.7	1.5	3.8	2	4.1	2.7	3.2
Clay	%	16	18	26	20	26	34	44	38	24	32	10	21	24	26	24	20	22	18
Org Mat	C%	0.22	0.45	0.42	0.33	0.05	0.45	0.65	0.47	0.41	0.51	0.03	0.35	0.32	0.05	0.42	0.1	0.34	0.13

Soil acidity/alkalinity

In general, it is accepted that the pH of a soil has a direct influence on plant growth. This may occur in a number of different ways, which include:

- The direct effect of the hydrogen ion concentration on nutrient uptake;
- Indirectly through the effect on major trace nutrient availability; and by
- Mobilising toxic ions such as aluminium and manganese, which restrict plant growth.

A pH range of between 6 and 7 most readily promotes the availability of plant nutrients to the plant. However, pH values below 3 or above 9, will seriously affect, and reduce the nutrient uptake by a plant.

The dominant soils mapped in this area are neutral to slightly acid (4.20 to 7.60), generally within the accepted range for good nutrient mobility. However, some of the soils derived from intrusive material will tend to be more alkaline than indicated by these results due to the potential buffering capacity of the moderately high levels of calcium carbonate. This may affect the pH of the soils to some extent. It is unlikely however, that they will be dramatically impaired.

Soil Salinity/Sodicity

In addition, to the acidity/alkalinity of a soil, the salinity and/or sodicity are of importance in a soils potential to sustain growth.

Highly saline soils will result in the reduction of plant growth caused by the diversion of plant energy from normal physiological processes, to those involved in the acquisition of water under highly stressed conditions. Salinity levels of <60mS/m will have no effect on plant growth. From 60 – 120mS/m salt sensitive plants are affected, and above 120mS/m growth of all plants is severely affected.

In addition soil salinity may directly influence the effects of particular ions on soil properties. The sodium adsorption ratio (SAR) is an indication of the effect of sodium on the soils. At high levels of exchangeable sodium, certain clay minerals, when saturated with sodium, swell markedly.

With the swelling and dispersion of a sodic soil, pore spaces become blocked and infiltration rates and permeability are greatly reduced. The critical SAR for poorly drained (grey coloured) soils is 6, for slowly draining (black swelling as found in this site) clays it is 10 and for well drained, (red and yellow) soils and recent sands, 15.

Generally, the soils mapped in this area tend toward being non saline in character, but could become susceptible to an increase in salinity if their water regime is not well managed, particularly on the more clay rich materials (Rensburg and Arcadia).

Soil Fertility

The soils mapped in this area returned at best only moderate concentrations of the nutrients required for good plant growth, with Zn, P and K generally lower than the optimum required, and the soil depths are inhibiting due to the extreme soil structure.

Significantly large areas of soil with an acceptable level of plant nutrition where mapped on soils that are not generally considered to be of an arable rating. These results can possibly be ascribed to either a natural anomaly in nutrient levels within the soil profile sampled, or to residual levels of fertiliser within the soil due to farming activities in the area.

In general however, there is phosphorus and zinc deficiency in the soils, and the organic carbon content is lower than the optimum.

Calcium levels are generally high to very high. This would normally have the capacity to restrict magnesium uptake. However, as the ratio between calcium and magnesium is approximately 3:1 a magnesium deficiency in the soils is unlikely.

There are no indications of any toxic elements that are likely to limit natural plant growth in the soils mapped within the study area.

Fairly standard fertiliser treatments will be needed for optimum agricultural production of crops on areas that have previously been planted, with exceptionally good water management being of paramount importance on both dryland as well as irrigated lands.

Nutrient Storage and Cation Exchange Capacity (CEC)

The potential for a soil to retain and supply nutrients can be assessed by measuring the "cation exchange capacity" (CEC) of the soils.

The low organic carbon content is balanced to some extent by the relatively high clay content which naturally provides exchange sites that serve as nutrient stores. These conditions will result in a moderate retention and supply of nutrients for plant growth.

Low CEC values are an indication of soils lacking organic matter and clay minerals. Typically a soil rich in humus will have a CEC of 300 me/100g (>30 me/%), while a soil low in organic matter and clay may have a CEC of 1-5 me/100g (<5 me/%).

Generally, the CEC values for the soils mapped in the area are moderate to low, due to the moderate clay contents but poor organic matter content.

Soil Organic Matter

The organic matter content of the soils is low to moderate, with values raging from 0.2-0.8%. "Normal" soils have an organic matter content of 1-2%. Within the range of 0-4%, soil erodibility tends to decrease appreciably as organic matter increases, and the magnitude of organic matter effect is related to texture. Organic matter content of a soil is important in determining the soil erodibility factor K and the N mineralisation potential.

Soil Physical Characteristics

A significant proportion of the soils mapped exhibit a pedel to weak structure, moderate clay contents and mesotrophic to dystrophic characteristics.

Due to the texture and structure inherent in these soils, compaction within the "A" horizon is likely to occur if heavy machinery is used during the wet summer months over unprotected ground, while the sensitivity of the soils to erosion is a factor to be considered during the rehabilitation process (refer to section on Soil Handling and Removal and Mitigation and Management Measures)

A large proportion of the overall area to be affected by the construction operations and its associated infrastructure is underlain by soils with a more sensitive nature to heavy traffic. This will affect both compaction and erosion of the materials if not well managed

The area is flat to undulating, with wide open drainage lines and active water ways. The natural movement of eroded materials has resulted in the distribution of differing soils associated with the midslopes and lower midslope positions. The upper slopes and midslopes are dominated by erosion platforms and old land surfaces, while the lower slopes are dominated by recent accumulations of transported materials (colluvial) from the upslope positions in the alluvial floodplains of the major rivers and their tributaries. The end result is a complex of differing soil forms within a relatively small spatial area.

5.3.2.3 Characteristics of Different Soil Groups

The Heavy Clay Rich Soils

The colluvial derived soils and those derived from the more basic parent materials (intrusive diabase and dolerite) returned structures within the soil profile that are expansive, with notable cracking within the soil profile in the dry state, and indications of slickenslides in the wet state.

Generally the C-horizons that underlie these horizons are composed of moderately hard and shallow weathering rock (saprolite). Intake rates and drainage of these soils are poor, while the erosion hazard is moderate.

These soils generally have a moderate to low nutrient status, and are subject to serious physical limitations if the soils are worked too wet or too dry.

The major soils that fit this category include the Rensburg, Arcadia and to some degree the Swartland and/or Sterkspruit soil Forms. These soils are characterised by dark brown to black vertic or melanic (crumbly) topsoil's and moderate blocky to massive and vertic structured, clay rich "B" horizons. These soils are poorly drained and will pose a problem to handling and re-working during the construction as well as the rehabilitation phases.

Erosion and compaction are the main problems that will need to be managed on these soil types. This is due to the sensitivity of the soils to mechanical disturbances during/after the removal of surface vegetation. The existing and established vegetation binds and stabilises the soils ensuring fair growing conditions and good soil retention.

These same conditions will need to be emulated as soon after storage/stockpiling and/or rehabilitation of the soils has been undertaken.

Light Textured -Yellow-brown and Red Apedal Soils

More extensive areas of lighter textured soils are found associated with the sedimentary geology and will be of the more significant materials affected by the proposed infrastructure and surface development.

The lighter textured soils (Hutton, Clovelly and Glencoe) are characterised by an orthic A-horizon overlying a red or orange to brown apedel "B", with possible indications of a ferricrete layer in the B/C-horizon.

The lithologies encountered are generally resistant, massive, intrusive geologies, resulting in shallow weathering within the saprolitic zone.

The working of these soils as well as the storage (stockpiling) will need to be well managed.

Shallow Soils

The generally shallow rooting depths of the soils that dominate the area (<500mm) are associated with the hard and resistant lithologies that underlie the site.

5.3.2.4 Soil Distribution

The distribution of the soils (see Figure 5.3.1.1(d) for Combined Soil Polygon Map) is closely linked to the topography and parent materials from which they are derived and their position in the topography (Refer to Figure 5.3.2.4(a) – Typical Orthic Phase - Catena).

The distribution of the soils is a function of the topography, erosion profile and climatic conditions.

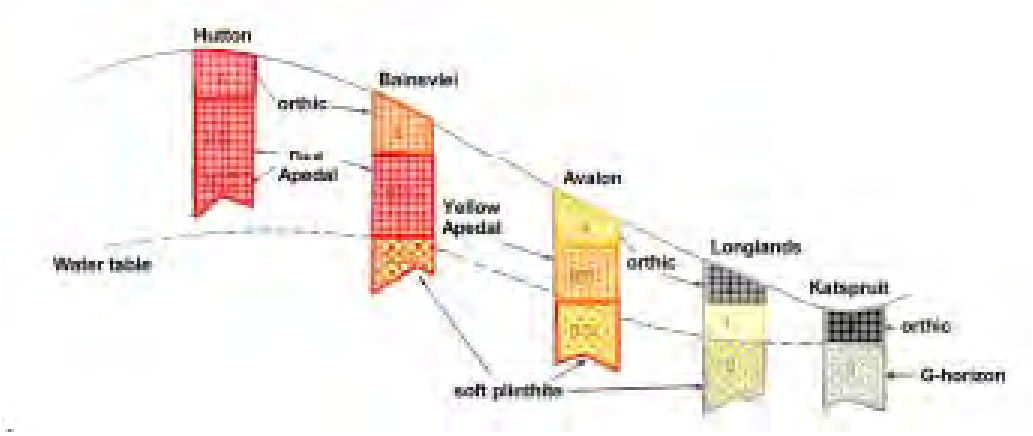


Figure 5.3.2.4(a): Typical Catena

5.3.2.5 Soil Depth

The average soil depths of the areas that are to be disturbed were determined using a bucket auger (1.5m) as well as a number of soil pits, and any existing excavations (refer to Soil Characterisation - Mapping).

On average, the sandy loams and sandy clay loams returned rooting depths between 500mm and 1,200mm, while the transitions zone soils returned depths of between 500mm and 600mm.

The hydromorphic soils forms returned shallower rooting depths of between 300mm and 500mm.

The structured soils forms range from 300mm to 500mm, while the Rensburg, Arcadia and Bonheim Forms returned E.R.D's from 200mm to 400mm.

A number of the recently excavated pits and other areas of exposure were used to obtain a clear cross section through the soil profiles. These areas were used to obtain a better understanding of the soil catena in the area.

The stripping ratios of the topsoil, subsoil and overburden should be based on the soil classification mapping – Refer to Figure 2.1.1, while detailed information will need to be obtained for the actual surface areas that are to be disturbed before soil stripping begins. It is imperative that these areas are assessed in more detail as part of the design phase.

5.3.2.6 Soil Erosion and Compaction

The erosion potential of a soil is expressed by an erodibility factor ("K"), which is determined from soil texture, permeability, organic matter content and soil structure.

The Soil Erodibility Nomograph of (Wischmeier et al, 1971) was used to calculate the "K" value. An index of erosion (I.O.E.) for soils is then determined by multiplying the "K" value by the slope percentage. Erosion problems may be experienced when the Index of Erosion is greater than 2.

The "K" value is used to express the "erodibility" of a particular soil form. Erodibility is defined as the vulnerability or susceptibility of a soil to erosion. It is a function of both the physical characteristics of that soil as well as the treatment of the soil.

Erodibility ratings are expressed as:

Resistant	"K" factor = <0.15
Moderate	"K" factor = 0.15-0.35
Erodible	"K" factor = 0.35-0.45
Highly erodible	"K" factor = >0.45

The average "Erosion Indices" for the dominant soil forms on the study site are shown in Table 5.3.2.6(a). The majority of the soils mapped can be classified as having a moderate erodibility index.

This is largely ascribed to the generally low organic carbon content and the sensitivity of the soils to solution weathering. These factors are offset by the generally gentle to flat topography and the moderate clay contents. The vulnerability of the "B" horizon to erosion once/if the topsoil is removed must not be under estimated.

The wet and structured soils are susceptible to compaction due to the swelling clays that are common in the majority of the materials classified. These soils will need to be managed extremely well, both, during the stripping operation, as well as during the stockpiling/storage and rehabilitation stages.

The concerns around erosion and compaction are directly related to the fact that the protective vegetation cover and topsoil will be disturbed during any mining or construction operation.

Once disturbed, the actions of wind and water are increased. Loss of soil (topsoil and subsoil) is extremely costly to any operation, and is generally only evident at closure or when rehabilitation operations are compromised.

Well planned management actions during the construction and operational phases will save time and money in the long run, and will have an impact on the ability to successfully "close" an operation once completed.

Table 5.3.2.6(a): Erodibility of Differing Soil Forms

Soil Form	Erodibility Index	Index of Erosion (I.O.E.)
Hutton, Clovelly, Griffin	Moderate	1.30 – 1.40
Glencoe, Dresden	High	1.40 – 1.60
Valsrivier/Swartland	High	1.40 – 1.60
Sepane	Moderate\to high	1.35 – 1.45
Kroonstad, Katspruit	Moderate to High	1.35 – 1.45
Rensburg, Arcadia	Moderate to High	1.30 – 1.45
Avalon, Pinedene, Bloemdal	Moderate to High	1.15 – 1.35
Mispah, Glenrosa	High	1.45
Westleigh/Longlands	Moderate to High	1.30 – 1.45

5.3.2.7 Dry Land Production Potential

The dryland production potential of the shallow soils and the more structured Forms, are poor. The deeper, and apedel soil are easier to cultivate and have a better propensity to both drainage as well as the holding of moisture within the soil that is available to the plant. These soils are more productive dryland materials that are also easier to manage.

5.3.2.8 Irrigation Potential

The irrigation potential for the soils is "moderate to good" in terms of the soil structure and drainage capability. With good water management, and adequate drainage, the deeper (>700mm) soils could be economically cultivated to irrigated crops.

The spatial distribution and occurrence of these soils is limited and it is unlikely that sufficiently large enough areas of soil are available to make the use of irrigation viable on anything other than highly intensive market gardening tunnel gardening.

Irrigation is practice to some extent in the area of study. Again, the spatial distribution of the soils with adequate soil rooting depths will limit the size of the areas that can be cultivated, thus limiting the potential for economic irrigation farming. In addition, for any irrigation to be undertaken in the area on a large (sustainable) scale, it would require the installation of a number of surface water impoundments as storage during the dry months.

A more detailed study would be needed if irrigated farming is to be considered as an "End Use" for the rehabilitated areas.

5.3.2.9 Soil Utilization Potential

In general, the soils that will be disturbed and that will require rehabilitation, are moderately deep to shallow, (ERD = 400mm to 800mm), moderately well drained, with a susceptibility to erosion and compaction and in a significant proportion of the study area show signs of wetness at depth (shallow or perched water table).

The wet based and structured soils will be difficult to work, both from a trafficability, workability, storage and rehabilitation point of view.

Compaction must be considered carefully as the working of the wet based and structured soils when wet (rainy season), will be detrimental and compaction will occur.

The structure of the soil will affect their workability, and provision will need to be made for the timing of the stripping and rehabilitation works to be undertaken if the structural integrity of these soils are to be maintained.

The potential for the use of the hydromorphic soils for economic crop production and/or market gardening is at best poor, and should not be considered for anything other than as wilderness/conservation lands (preferred option), while the potential for economic farming of the structured soils is considered at best to be "low intensity grazing land". The less structured and non hydromorphic soils are that cover a substantial portion of the site are considered arable class soils, and as such can be considered for use in low intensity livestock grazing and or arable crop production.

5.4 LAND CAPABILITY & LAND USE

5.4.1 Data Collection for Land Capability

The land capability of the study area was classified into four classes (wetland, arable land, grazing land and wilderness) according to the Chamber of Mines Guidelines (1991) and the Canadian Land Inventory System. The criteria for this classification are set out in Table 5.4.1(a) below.

Table 5.4.1(a): Criteria for pre-mining land capability (Chamber of Mines 1991)

Criteria for Wetland

- Land with organic soils or supporting hygrophilous vegetation where soil and vegetation processes are water determined.

Criteria for Arable land

- Land, which does not qualify as a wetland.
- The soil is readily permeable to a depth of 750 mm.
- The soil has a pH value of between 4.0 and 8.4.
- The soil has a low salinity and SAR
- The soil has less than 10% (by volume) rocks or pedocrete fragments larger than 100 mm in the upper 750 mm.
- Has a slope (in %) and erodibility factor (K) such that their product is <2.0
- Occurs under a climate of crop yields that are at least equal to the current national average for these crops.

Criteria for Grazing land

- Land, which does not qualify as wetland or arable land.
- Has soil, or soil-like material, permeable to roots of native plants, that is more than 250 mm thick and contains less than 50 % by volume of rocks or pedocrete fragments larger than 100 mm.
- Supports, or is capable of supporting, a stand of native or introduced grass species, or other forage plants utilisable by domesticated livestock or game animals on a commercial basis.

Criteria for Wilderness land

- Land, which does not qualify as wetland, arable land or grazing land.

5.4.2 Land Capability Description

The "Capability" of the land is a function of not only the soils and their relative depth and structure/texture, but also the geomorphological aspects of the area. The topographic slope, aspect and altitude combined with the climate and ground roughness (rockiness and percentage out crop) all needed to be considered when classifying the ability of the land.

In this rating system, it was decided based on the present land utilization, that the ability of the land to sustain agriculture was important, and that the economic potential of the area was measured at present in terms of its ability to be farmed. However, at closure, the area will needed to be rehabilitated and the baseline information presented here will be invaluable in making sound sustainable decisions that are economically viable to determine the End land Use.

Tables 5.4.2(a), 5.4.2(b) and 5.4.2(c) and Figures 5.4.2(a) 5.4.2(b) and 5.4.2(c) detail the distribution of land capability classes for the additional areas assessed in terms of the June 2010 Shondoni study. Table 5.4.2(d) details the findings of the 2002 Block 8 assessment.

Table 5.4.2(a): Land Capability 2010 Shondoni - Leeuwpan

Leeuwpan Land Capability Table		
Land Capability	Area (Ha)	% of Area
Wetland	231.16	32.37%
Canal	4.86	0.68%
Pan	475.37	66.58%
Stream	2.62	0.37%
Total Area (Ha)	714.02	100.00%

Table 5.4.2(b): Land Capability 2010 Shondoni – Northern Reserves

Northern Block Land Capability Table		
Land Capability	Area (Ha)	% of Area
Grazing	4.78	0.27%
Wilderness	811.42	46.05%
Wetland	441.47	25.06%
Town	234.79	13.33%
Road	75.69	4.30%
Railway	52.28	2.97%
Gholf course	21.56	1.22%
Refuse dump	7.44	0.42%
Stream	112.51	6.39%
Total Area (Ha)	1761.94	100.00%

Table 5.4.2(c): Land Capability 2010 Shondoni – Springbokdraai

Springbokdraai Land Capability Table		
Land Capability	Area (Ha)	% of Area
Grazing	28.18	1.49%
Wilderness	541.81	28.59%
Wetland	1195.91	63.11%
Stream	129.13	6.81%
Total Area (Ha)	1895.02	100.00%

Table 5.4.2(d): Land Capability 2002 Block 8 Assessment

Land Capability Rating	Area (Ha)	% of Total Area (Ha)
Arable	779.3	3.9
Grazing	3405.4	16.88
Conservation	10042.5	49.84
Wetlands	3474.1	17.25
Streams	1101.6	5.48
Out of Survey	1040.5	5.17
Disturbed Areas	299	1.48
Total Area	**20142.4**	**100**

5.4.2.1 Arable

The land capable of sustaining arable crop production comprises the deep well drained, red (Hutton) and yellow-brown (Clovelly and Griffin) soils that occur on the midslope and upper midslope positions. In addition, there are areas associated with the more structured soil Forms, specifically the Valsrivier Form soil, that are capable of cultivation under good management conditions.

The more structured and hydromorphic soils are not considered to be arable soils under the classification. Some of the heavier structured soils, as well as large areas of the hydromorphic soil types (Avalon's and Westleigh's) have been cultivated at present, specifically in the northern part of the survey area.

5.4.2.2 Grazing

The areas that classify as grazing land are generally confined to the shallower and more structured soil Forms that are moderately well drained. These soils are generally darker in colour, and are not always free draining to a depth of 750 mm, but are capable of sustaining palatable plant species on a sustainable basis especially since only the subsoils (at a depth of 500 m m) are periodically saturated. There are no rocks or pedocrete fragments in the upper horizons of any of the soil groups, which will limit the land capability to wilderness land.

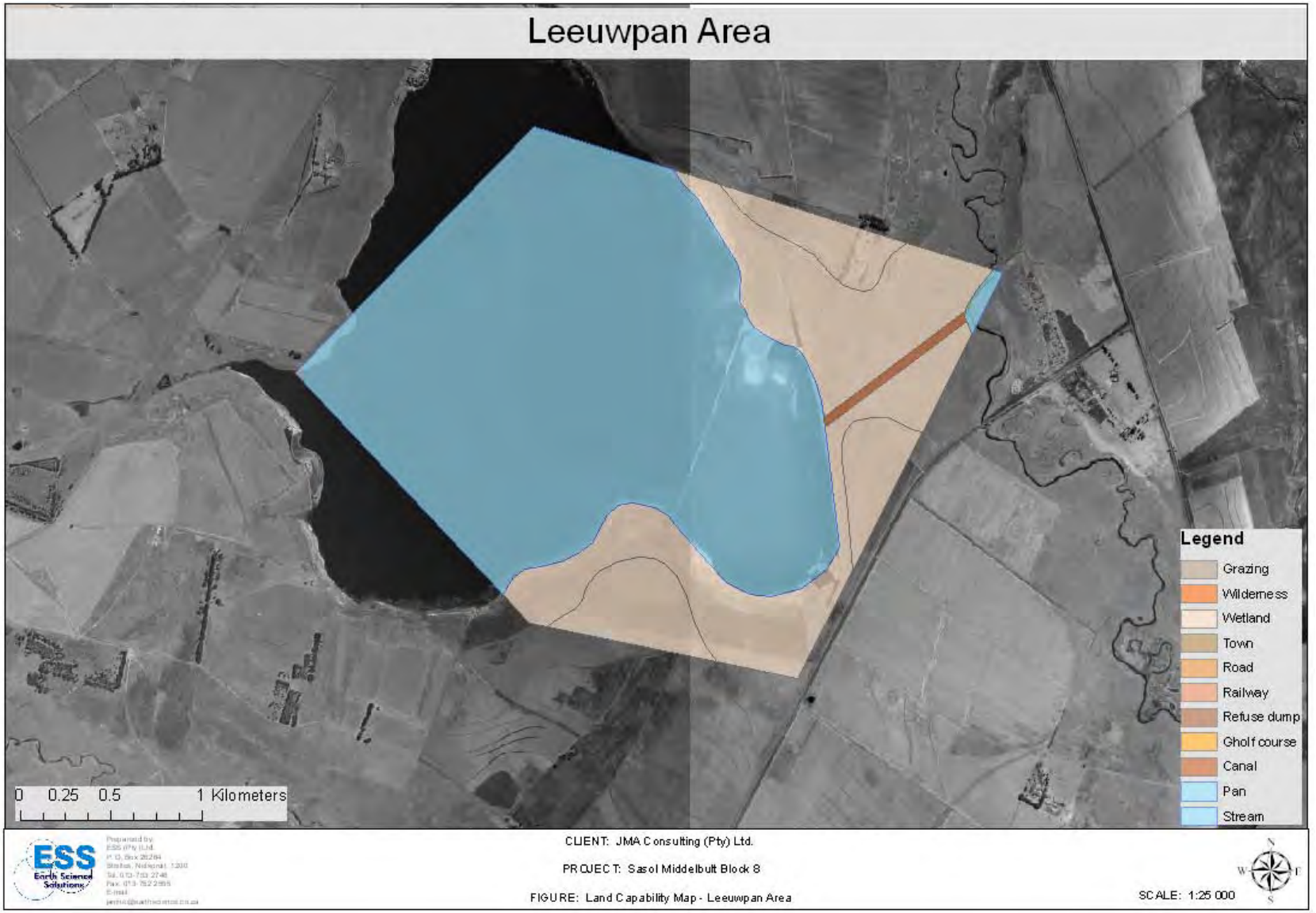


Figure 5.4.2(a): Land Capability Map – Leeuwpan Reserves

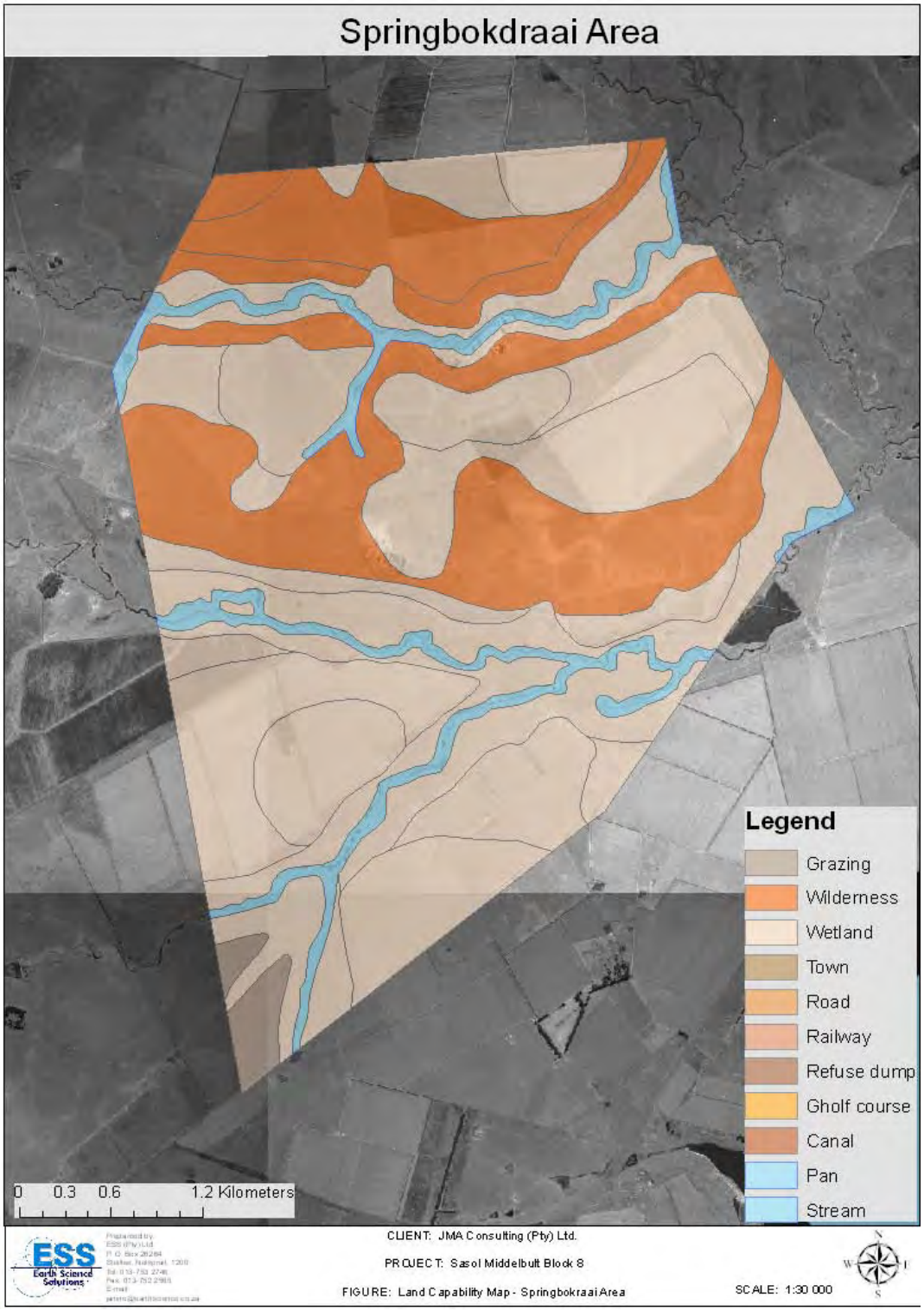


Figure 5.4.2(b): Land Capability Map – Springbokdraai Reserves

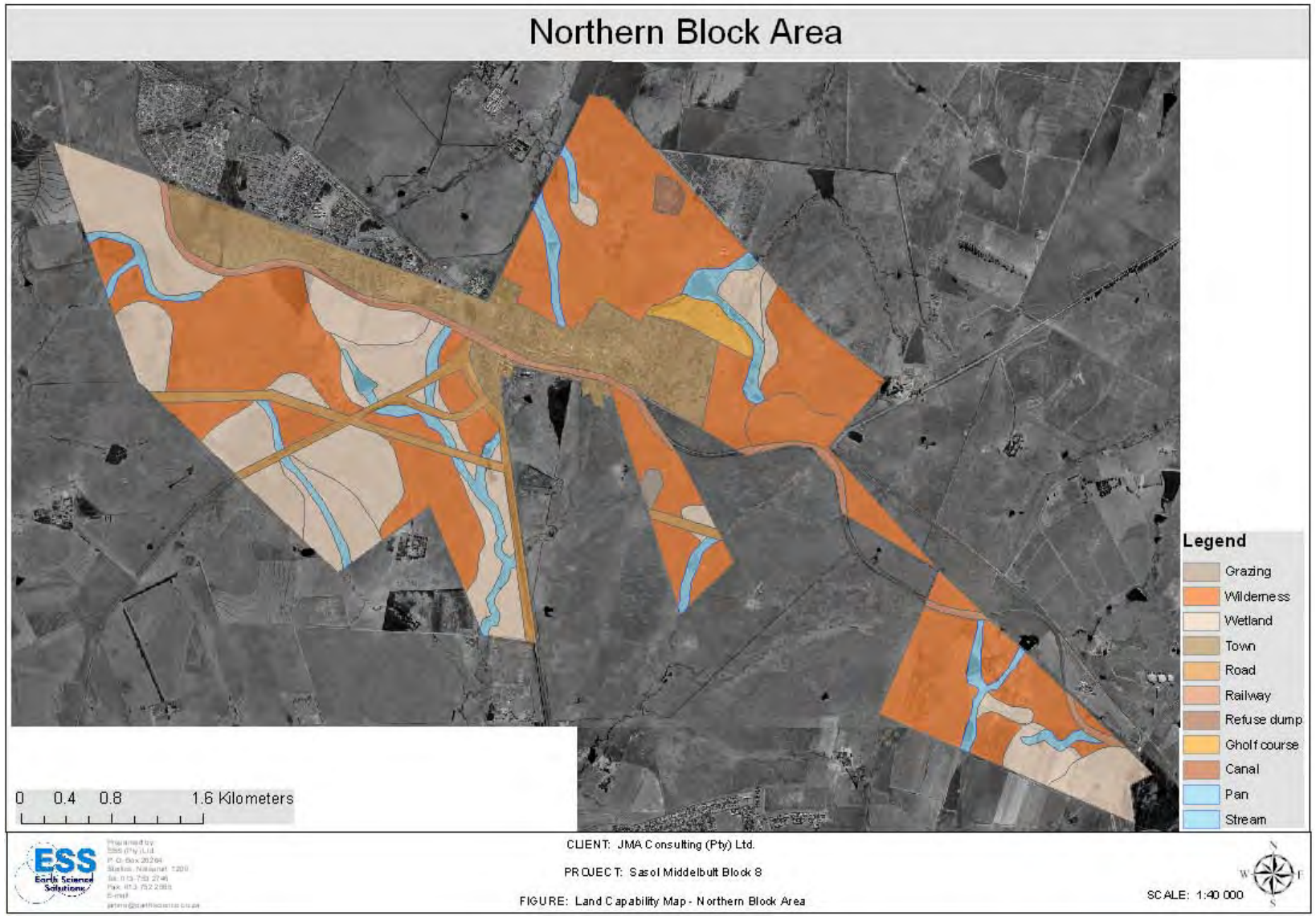


Figure 5.4.2(c): Land Capability Map – Block 8 – Northern Reserves

5.4.2.3 Conservation/Wilderness

The areas that classify as either conservation, or wilderness land are found associated with the shallow rocky soils that were mapped in association with the ridge slope positions that are defined by the less resistant dolerite dykes that have intruded into the sediments. These areas are confined predominantly to the southern portion of the area mapped.

5.4.2.4 Wetland

The wetland areas are defined in terms of the wetland delineation guidelines, which use both soil topography as well as botanic criteria to define the limits to this domain. In general, this zone is dominated by hydromorphic soils, and plant life that is associated with aquatic processes. The soils are generally dark grey to black in the topsoil horizons, and high in transported clays, and show pronounced mottling on Glayed backgrounds in the subsoils. The soils are within the zone of groundwater influence.

The area investigated is dissected by a number of prominent drainage lines that terminate in prominent river systems.

The combination of soil types and hydromorphic vegetation was used to delineate the wetland soils.

The pre-mining land capability of the site is defined by a combination of the topography, geology and the soils mapped in the area. Approximately 26.18% of the toal Block 8 – Shondoni area is classified as being of wetland type. See Figure 5.4.2(d) for the combined Block 8 - Shondoni Land Capability Map.

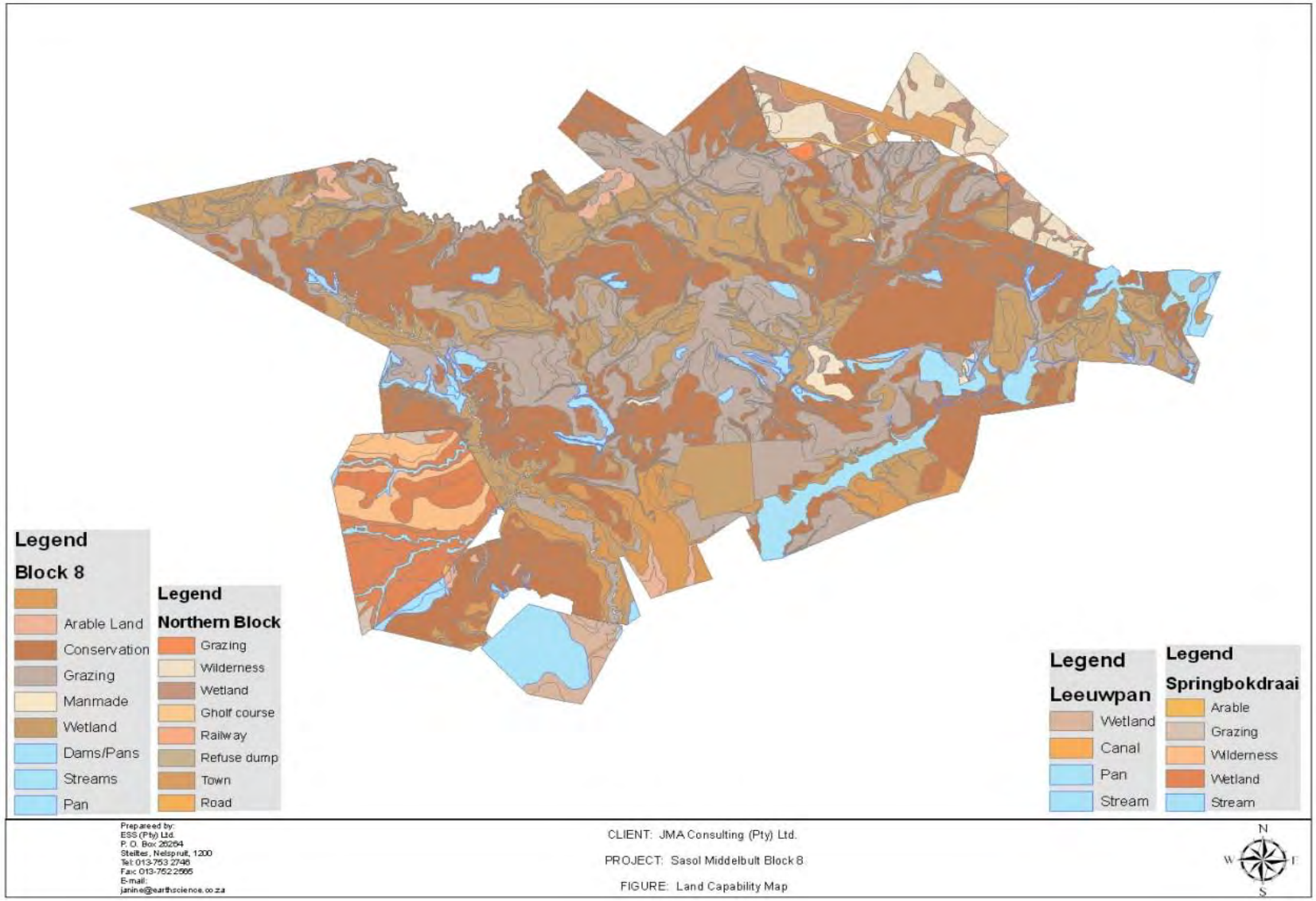


Figure 5.4.2(d): Land Capability Map – Block 8 – Shondoni Reserves

5.4.3 Data Collection for Current Land Use

A detailed, current land use description was compiled for the Block 8 EMPR Addendum in 2003, which remains the relevant land use base line for the bigger Block 8 mining area. During the soil and land capability surveys conducted during this current project for the additional reserve blocks at Leeuwpan, Springbokdraai and Block 8 Nortthen Reserves, the current land use in these areas was visually assessed using the orthophotographs as well as with site observations performed during the walk over field study which was done as part of the ground truthing and during which changes in the cropping regime and general land use for the area was recorded.

5.4.4 Current Land Use Description

The land use map compiled during the block 8 EMPR Addendum was used as base map and the new information generated was appended to the map. The updated Current Land Use map is shown in Figure 5.4.4(a).

Land use within the Block 8 study area is predominantly agriculture, consisting of maize cropping and grazing. Underground gold mining activities also occur in the area and surface infrastructure consists of shaft complexes and gold slimes dams. Human settlements in the south and east of the study area are largely urbanised with scattered farmsteads and farm worker houses in the north-western area.

Mixed commercial and residential land use activities are concentrated in the towns of Evander located in the east while the residential area of Brendan village occurs in the west.

The towns and residential areas of Secunda, eMbalenhle and Kinross are located adjacent to the south-eastern, southern and northern boundaries of the study area, respectively. The adjacent land use consists of agricultural activities in the north and west, mixed commercial and residential activities to the south and east, coal and gold mining activities occur in the region with concentrations to the south, and industrial activities (Sasol Synfuels) in the southeast.

Structure plans for the Govan Mbeki Municipality indicate future expansion of Secunda, Kinross, Evander and eMbalenhle towards each other along axes between the towns. This plan will soon be revised in terms of new legislation.

The current land use attributes undoubtedly represents the dominant component of the landscape character.

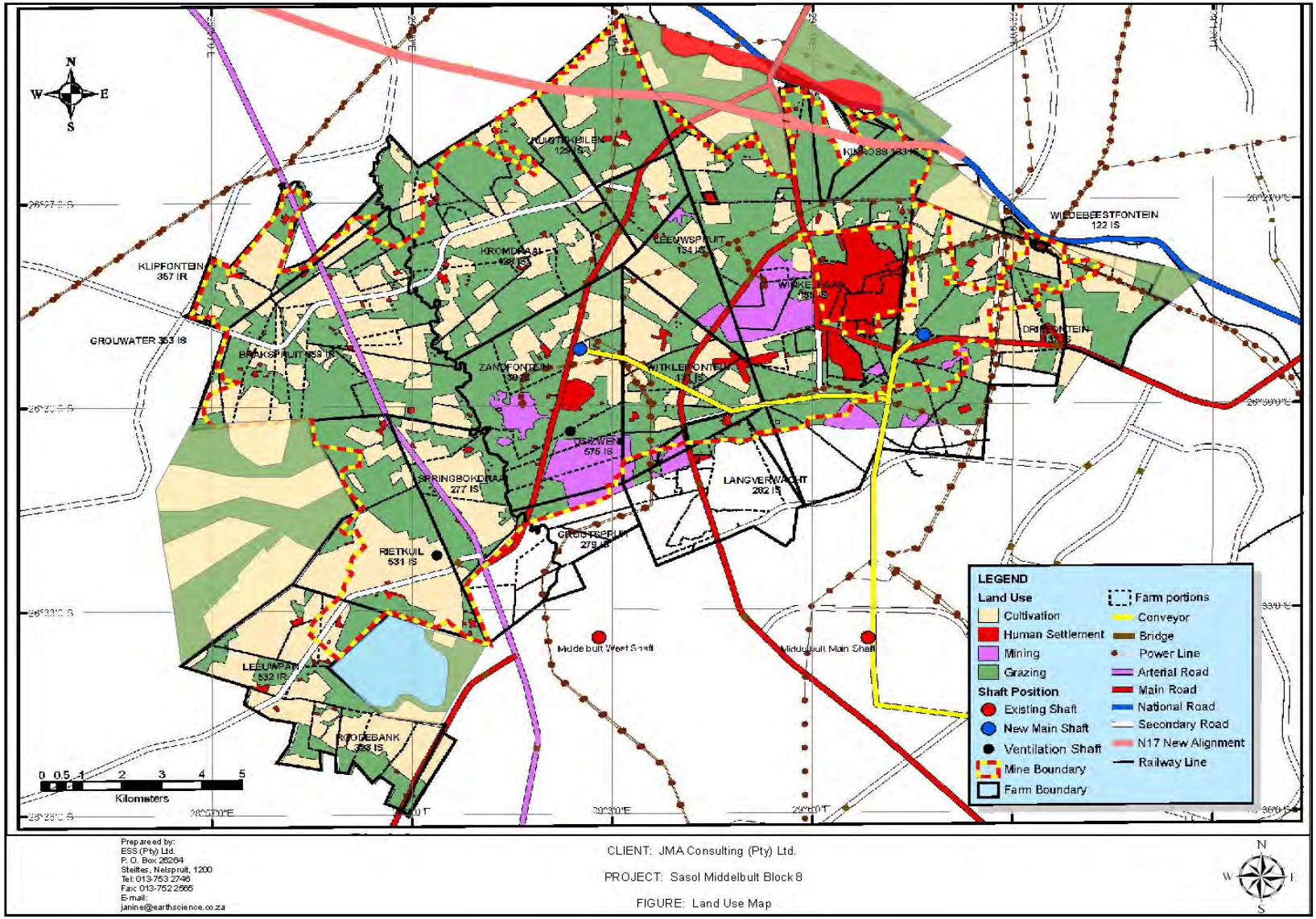


Figure 5.4.4(a): Current Land Use Map – Block 8 – Shondoni Reserves

5.5 GEOLOGY

The geology across the extent of the study area forms the basis for the topography, soils, vegetation, ground water and surface water components of the biophysical environment, whilst at the same time provides the setting for the extensive underground mining operations. The geology and nature thereof, therefore represents a crucially important component of the overall environment.

A fundamental understanding of the geology at Shondoni is thus a prerequisite on which to base impact assessments for soils, vegetation, ground water and surface water and from which to design and implement effective environmental management measures related to these environmental components.

The terms of reference for the geological base line study are as follows:

- Provide the regional geological setting in order to conceptualize the ground water and mining environments.
- Provide site specific quantitative geological information in support of the soils and ground water baseline studies and impact assessments, including aspects related to lithology, stratigraphy, mineralogy, geochemistry, weathering profile and structural features such as faults, dykes and sills.
- Provide an understanding of the environment within which the underground mining operations take place.

5.5.1 Approach and Methodology

The geological investigation comprised a quantitative site specific investigation using the geological data obtained from the Sasol Mining Geology Department. The approach and methodology that was followed for the compilation of the geology baseline report is systematically described below.

The investigation comprised of the following:

- Obtain, review and verify existing geological and mining information. This included regional geological information as well as historical information related to mining, contained in old and current Environmental Management Programme Report's (EMPR's).

- Verify the existing geological information within the study area. The geological information supplied by the Sasol Mining Geology Department was obtained from over 600 exploration boreholes. 30 additional monitoring boreholes were sited and were drilled. The boreholes were drilled in pairs (one shallow (SSW-) and one deep (SDF-) borehole) and were used to determine the geohydrological differences between shallow weathered zone aquifers and deeper Karoo aquifers. Each borehole was geologically profiled according to the lithology, weathered status and physical properties of the underlying host rock that it penetrated.

- Compile information sets including borehole logs and site reports, diagrams, thematic maps and contour maps. The cross sections provided by the Sasol Mining Geology Department are included as well.

- Discuss the geological setting based on the information obtained from the geological logs recorded at the exploration and monitoring boreholes.

- Identify and analyse the different lithological units. Determine the geochemical composition as well as the acidification potential of each of the lithological units.

5.5.2 Regional Geology

The aim of this regional geological discussion is not intended to elaborate on the tectonics and formation of the geological attributes of the area, but rather to delineate the geological features of interest, describe the stability of the lithologies and set the scene for the geohydrological discussion as well. The occurrence and movement of ground water, as well as the ground water quality, are functions of the geological host rock in which the ground water occurs, including the alteration thereof as a result of human activities, such as mining.

The regional geology of the across the extent of the study area will be discussed with reference to the clipped region of the 1:250 000 Geological Map Series of South Africa – Sheet 2628 EAST RAND, (1986), displayed as Figure 5.5.2(a). The extent of the study area (Total Mine Lease Area) is delineated by and includes the Middelbult Reserve, Block 8 Reserve, New Block 8 Northern Reserve, Springbokdraai Reserve as well as the Leeuwpan Reserve. The extents of the individual reserves are delineated by the green lines, whilst the position of the proposed Shondoni Shaft is located by the yellow star on Figure 5.5.2(a).

The Regional Geology Map depicts that the surface geology within and adjacent to the Study Area is dominated by the sedimentary rocks of the Vryheid Formation (Pv) as well as Jurassic Age Dolerite Intrusives (Jd).

The Vryheid Formation forms part of the Ecca Group of the Karroo Supergroup, and outcrops extensively across the study area. The Vryheid Formation generically consists of interbedded sandstones and shale layers. Carbonaceous shale and coal layers are generally associated with the Vryheid Formation as well. The dolerite present within the study area (Jd) is younger than the Vryheid Formation and intruded into and through the sedimentary rocks of the Vryheid Formation. The dolerite intrusions typically occur as dykes and sills and are often responsible for the devolatization of the coal adjacent to the dolerite intrusions. The river beds across the study are typically associated with the deposition of tertiary and quaternary sands and sediments.

Figure 5.5.2(a) indicates that gold (Au), silver (Ag) and coal (C) has been or is currently being mined within the study area as well.

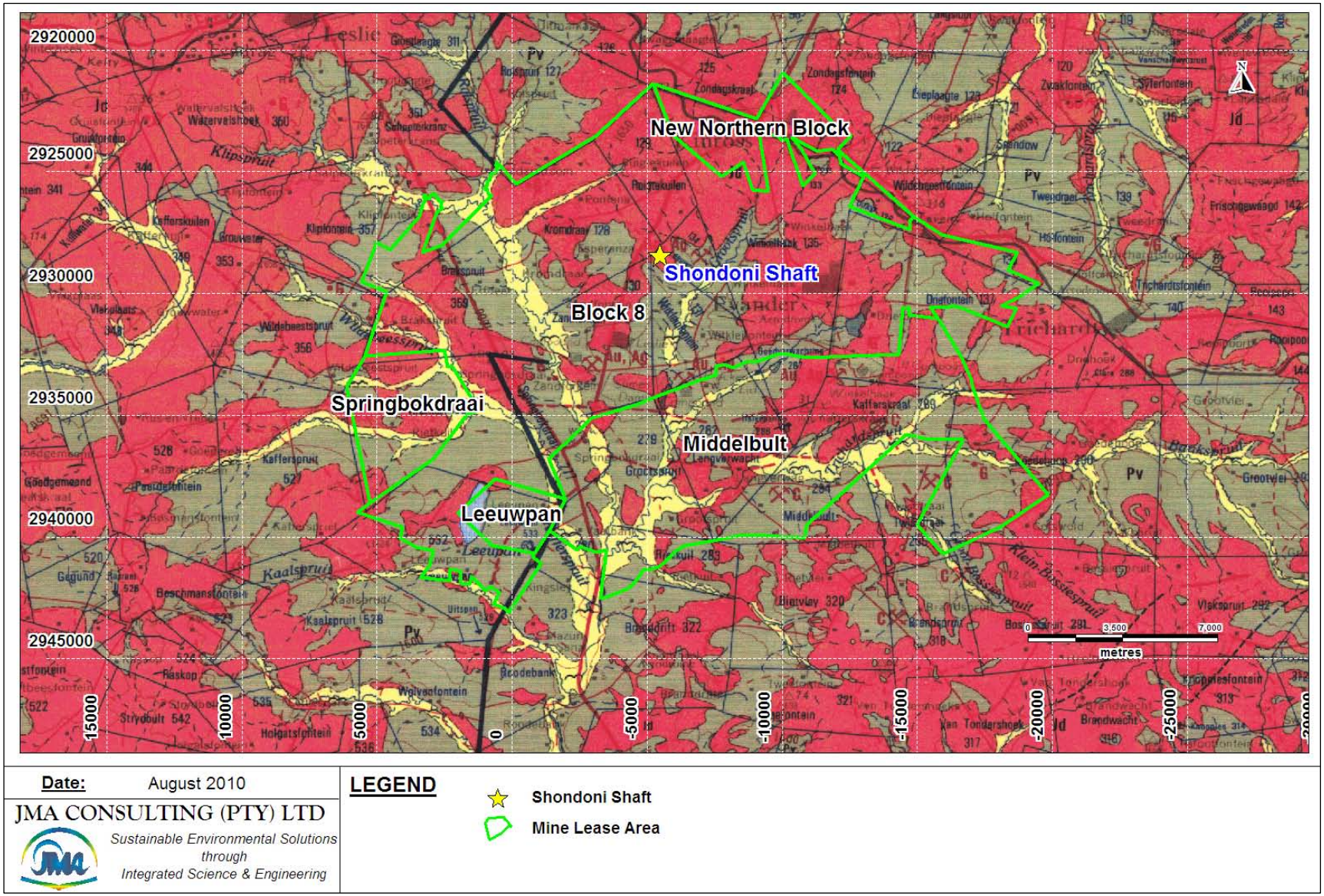


Figure 5.5.2(a): Middelbult – Block 8 – Shondoni Regional Geology

5.5.3 Geology of the Mine Lease Area

The site specific geology will be discussed with regards to the geological information recorded in the database which was provided by Sasol Mining's Geology Division and is therefore limited to the amount of geological data available at the time of the compilation of the report. The geological data was obtained from the geological logs recorded from over 600 exploration boreholes across the Mine Lease Area (Study Area). The geological information was statistically assessed and evaluated with regards to the lithological thicknesses and structural compartmentalization.

In addition to the exploration boreholes, 30 geohydrological monitoring boreholes were drilled. These boreholes were logged according to the geology which they penetrated as well as the geohydrological properties of the subsurface. These boreholes were drilled in pairs (one shallow (SSW-) and one deep (SDF-) borehole) and were used to determine the geohydrological differences between shallow weathered zone aquifers and deeper Karoo aquifers. The geological logs and boreholes site reports of the geohydrological monitoring boreholes are attached in Appendix 6(A) of the Geology Specialist Report attached as Volume 3 – APPENDICES to this report.

Four cross sections (see Figure 5.5.3(a) for cross section line localities) were compiled by Sasol's Geology Division and are shown as Figure 5.5.3(b), Figure 5.5.3(c), Figure 5.5.3(d) and Figure 5.5.3(e) respectively. The site specific geology will be discussed with reference to these cross sections as well as the information obtained from the geological logs generated for each of the exploration boreholes as well as the ground water monitoring boreholes. The locations of the exploration boreholes, monitoring boreholes as well as the external user boreholes are indicated in Figure 5.5.3(f).

Figure 5.5.3(g) shows the intersections of the main dolerite structures associated with the No. 4L coal seam as well as the major fault zones within the study area. The extent of coal devolatilization associated with the different dolerite intrusions are indicated on Figure 5.5.3(g) as well. The interpolated elevations of the No. 4L coal seam floor are indicated in Figure 5.5.3(h), whilst the proposed underground mining extent and layout for the No. 4 coal seam is depicted in Figure 5.5.3(i). The interpolated elevations of the No. 2 coal seam floor are indicated in Figure 5.5.2(j), and the proposed underground mining extent and layout of the No. 2 coal seam is depicted in Figure 5.5.3(k).

It is evident from the Figures 5.5.3 (i) and 5.5 .3(k) that the current proposed underground mining extent of the No 4 Coal Seam is far larger than for the No 2 coal seam. The coal will be mined out by standard Board and Pillar as well as High Extraction underground mining methods from the No 4 seam, whilst the No 2 seam will be entirely mined by standard Board and Pillar underground mining methods. The detailed mine layout and underground mining extents will not be discussed as part of the geology baseline study.

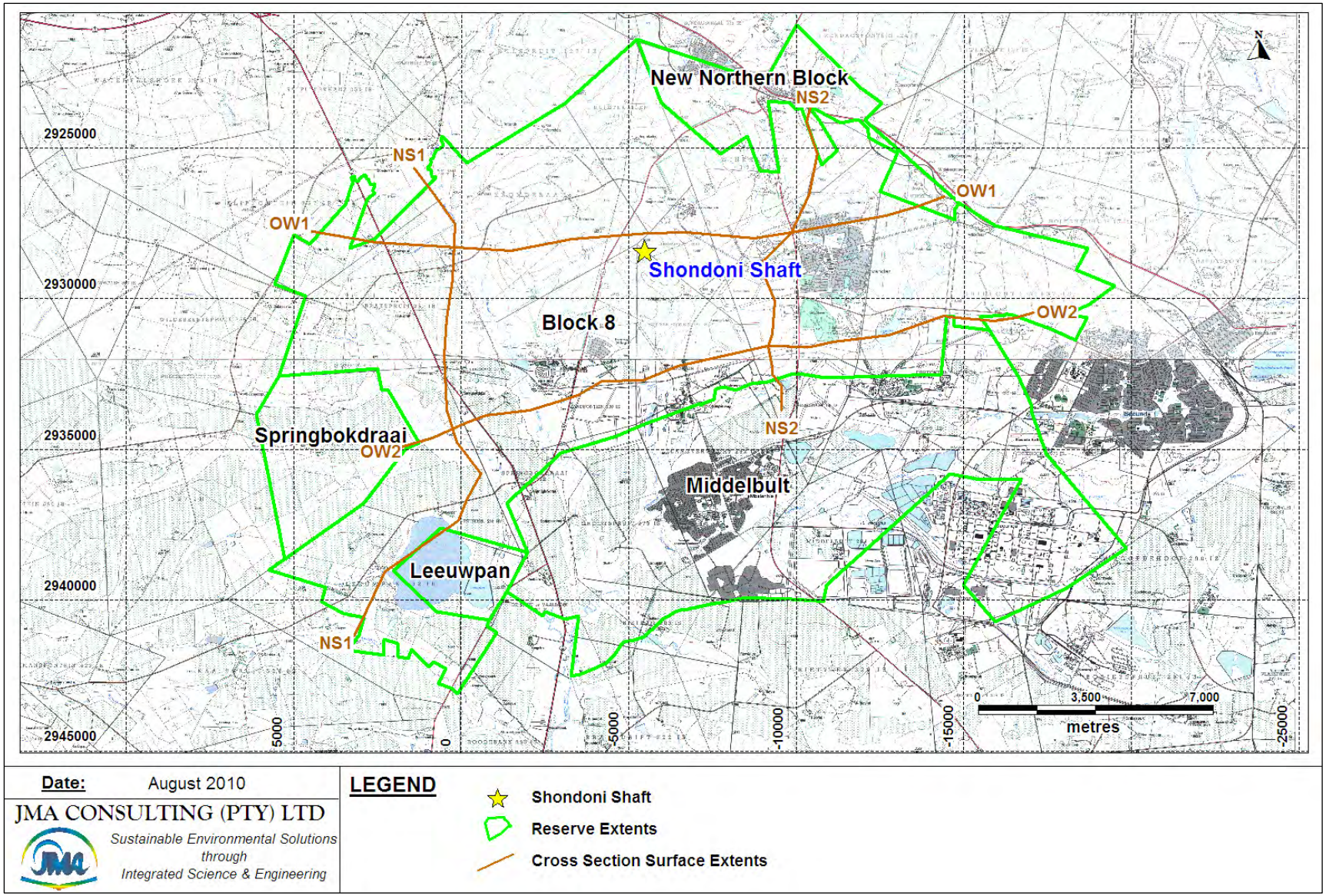


Figure 5.5.3(a): Localities of Geological Cross Sections

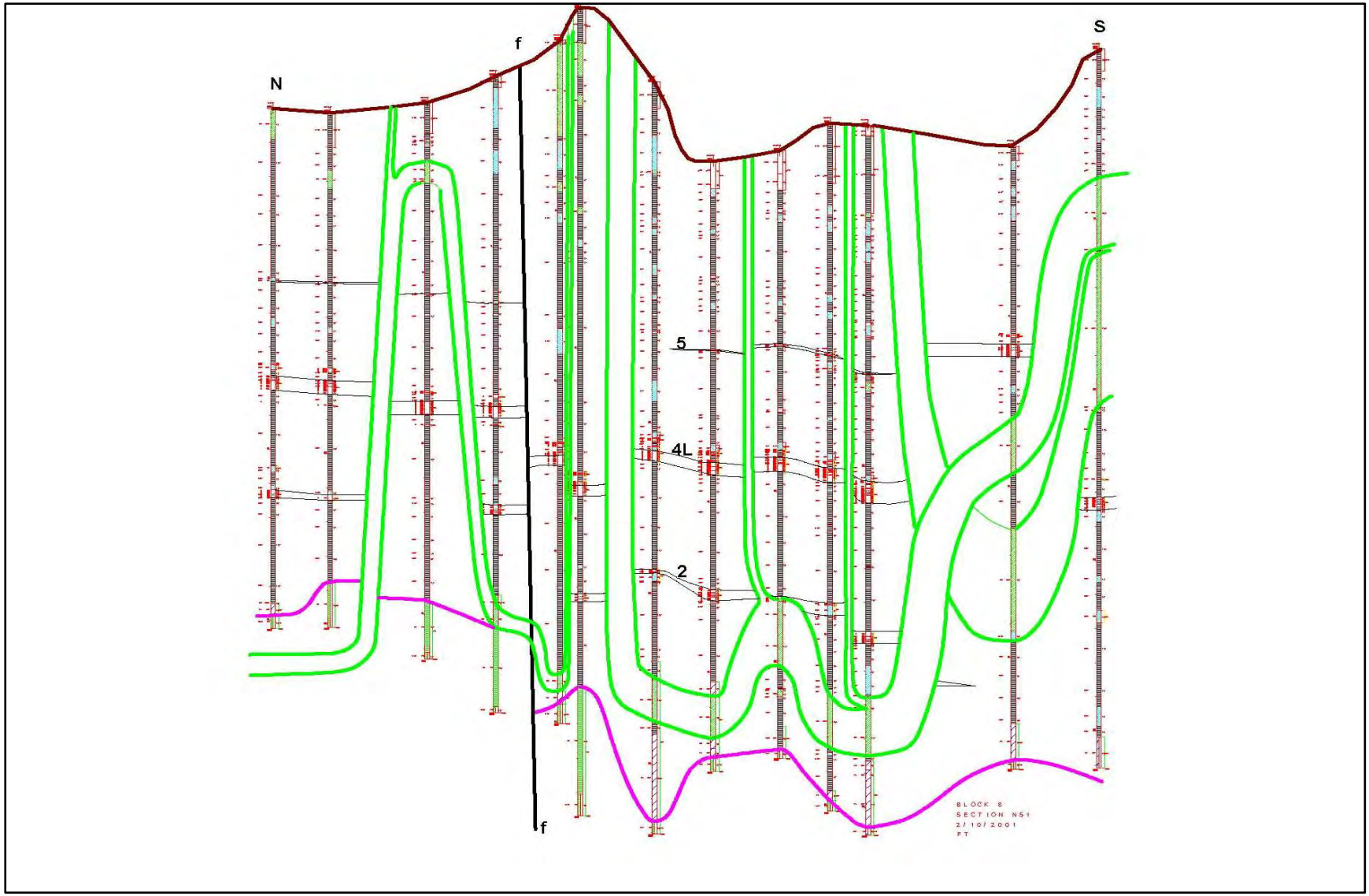


Figure 5.5.3(b): Geological Cross Section N-S(1)

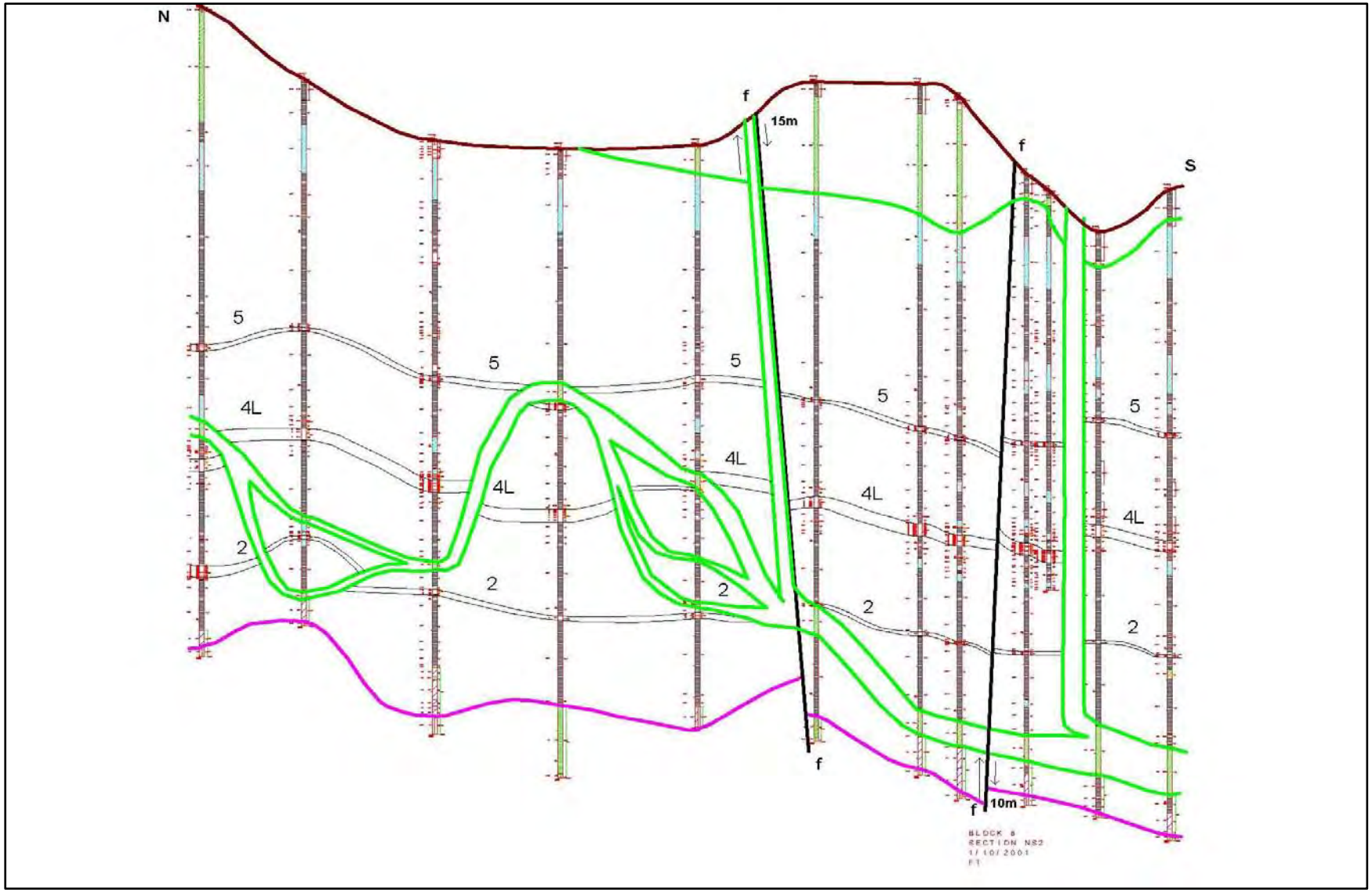


Figure 5.5.3(c): Geological Cross Section N-S(2)

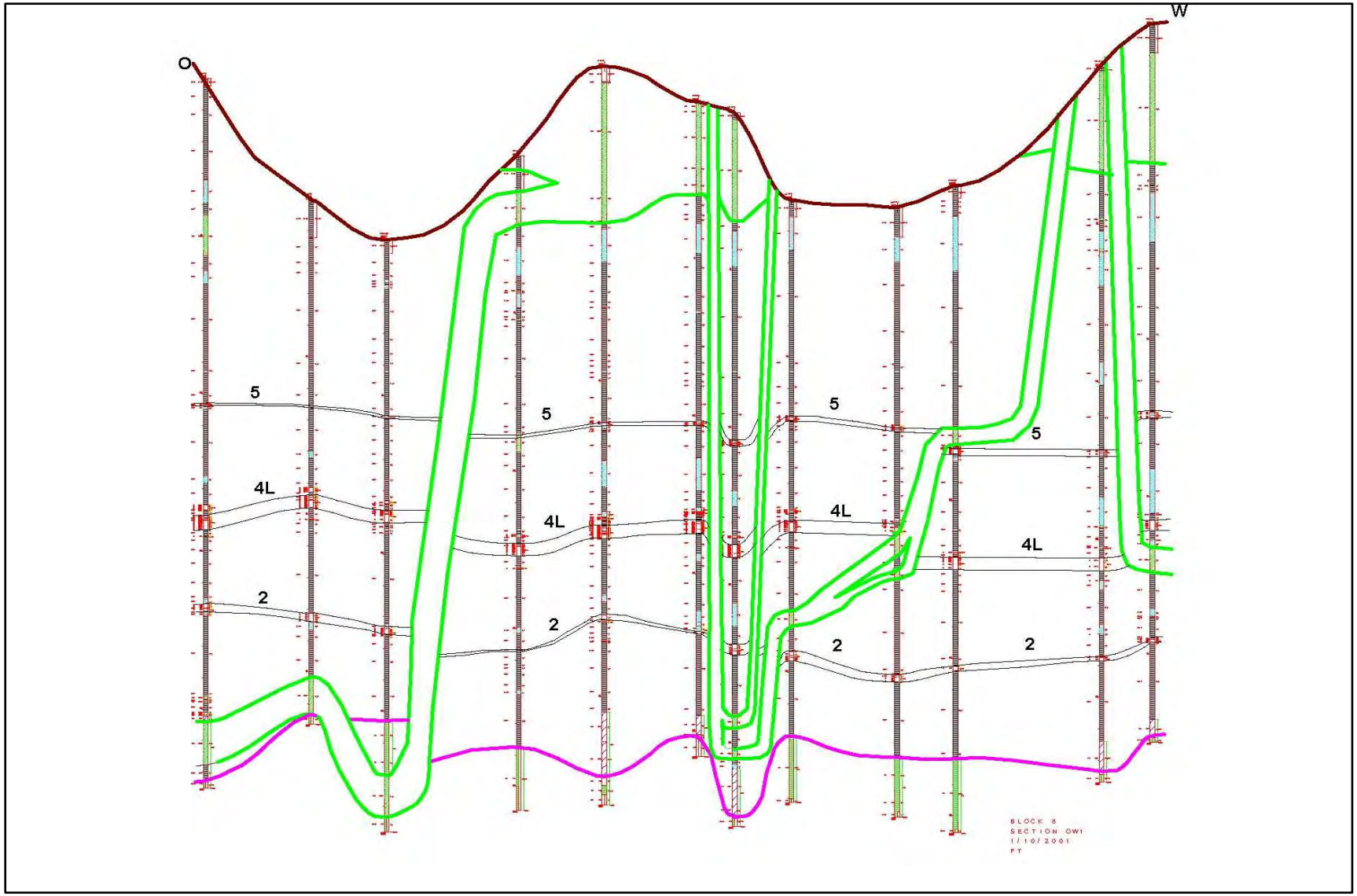


Figure 5.5.3(d): Geological Cross Section O-W(1)

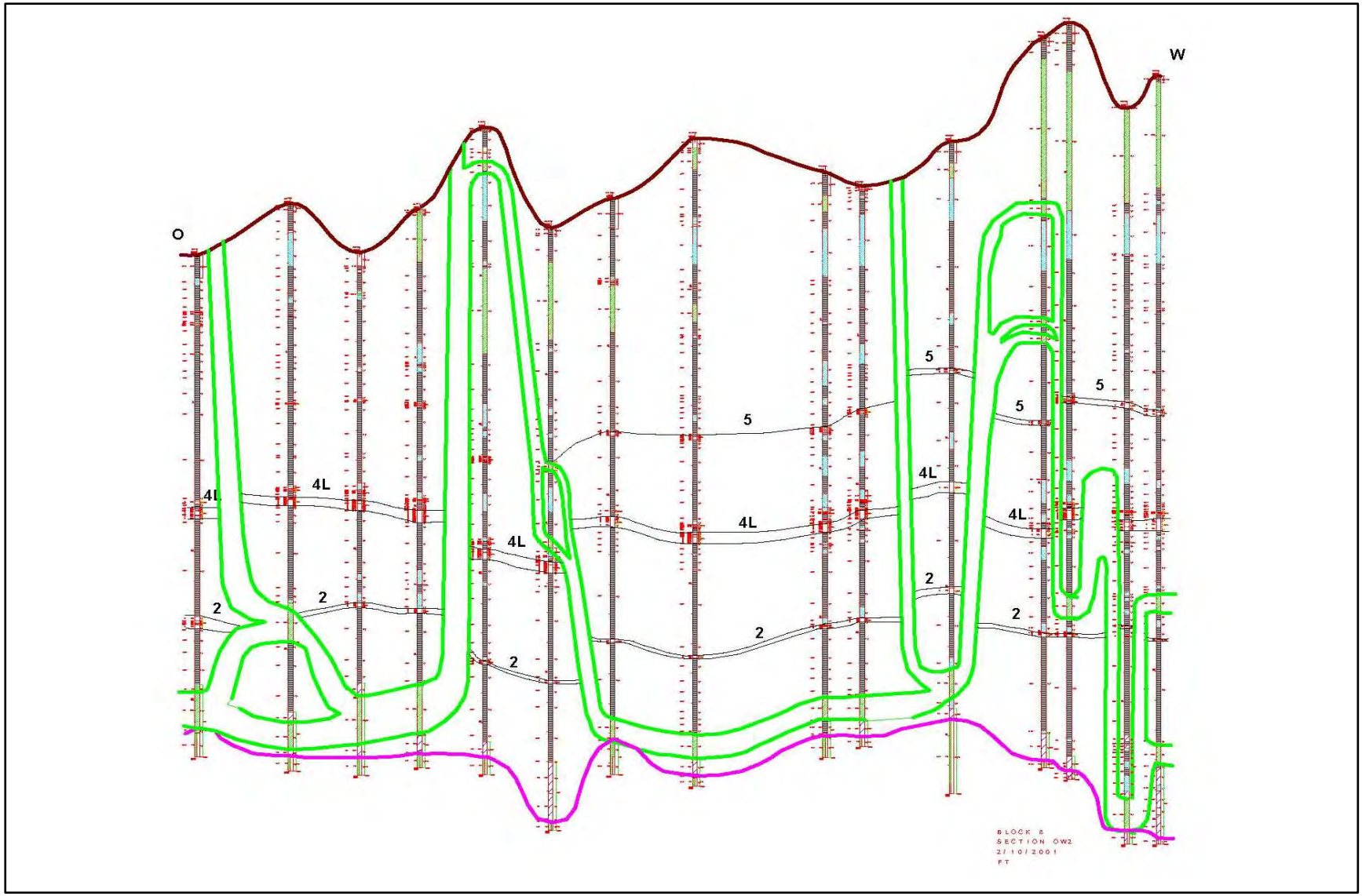


Figure 5.5.3(e): Geological Cross Section O-W(2)

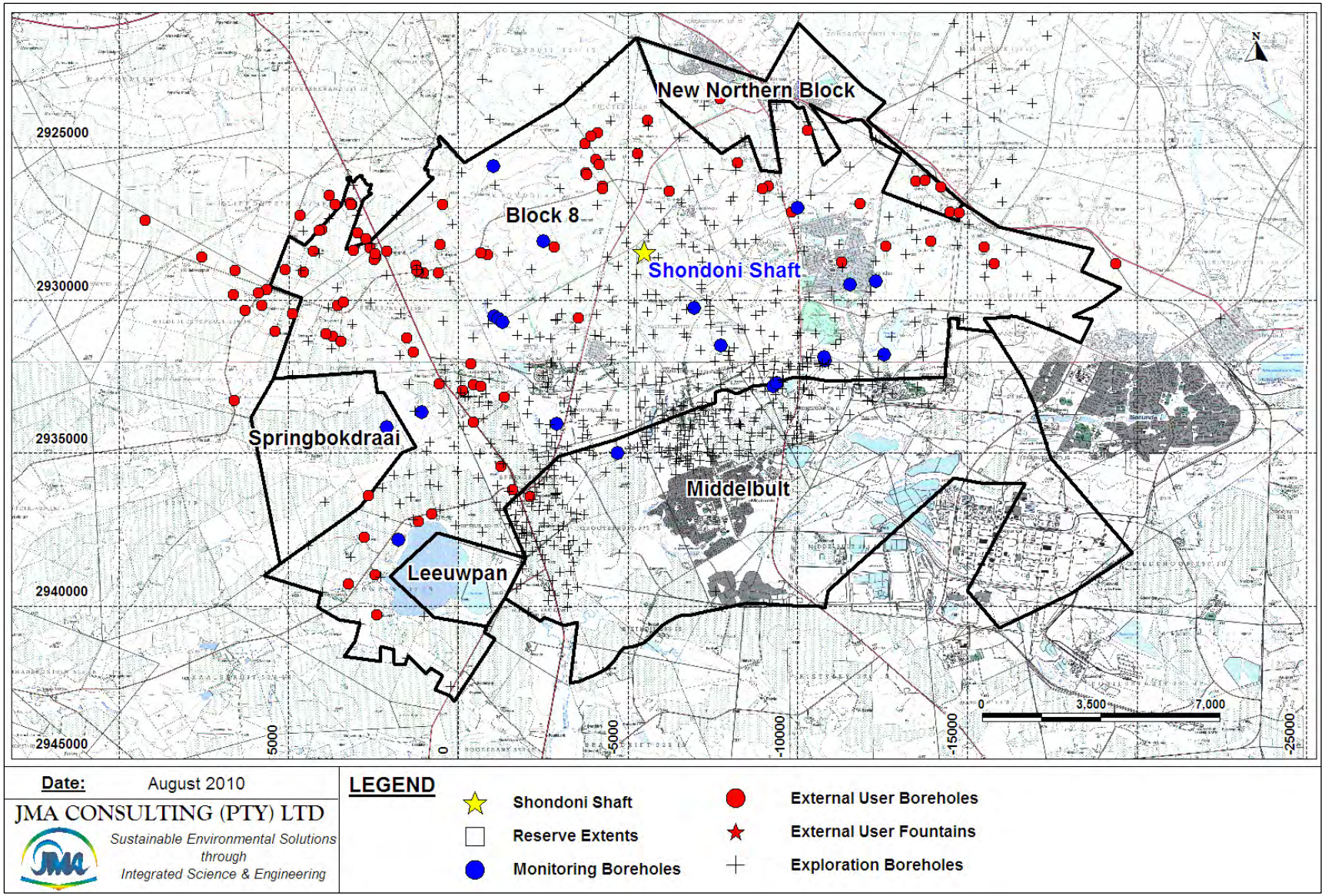


Figure 5.5.3(f): Exploration Borehole, Monitoring Borehole and External User Borehole Locations

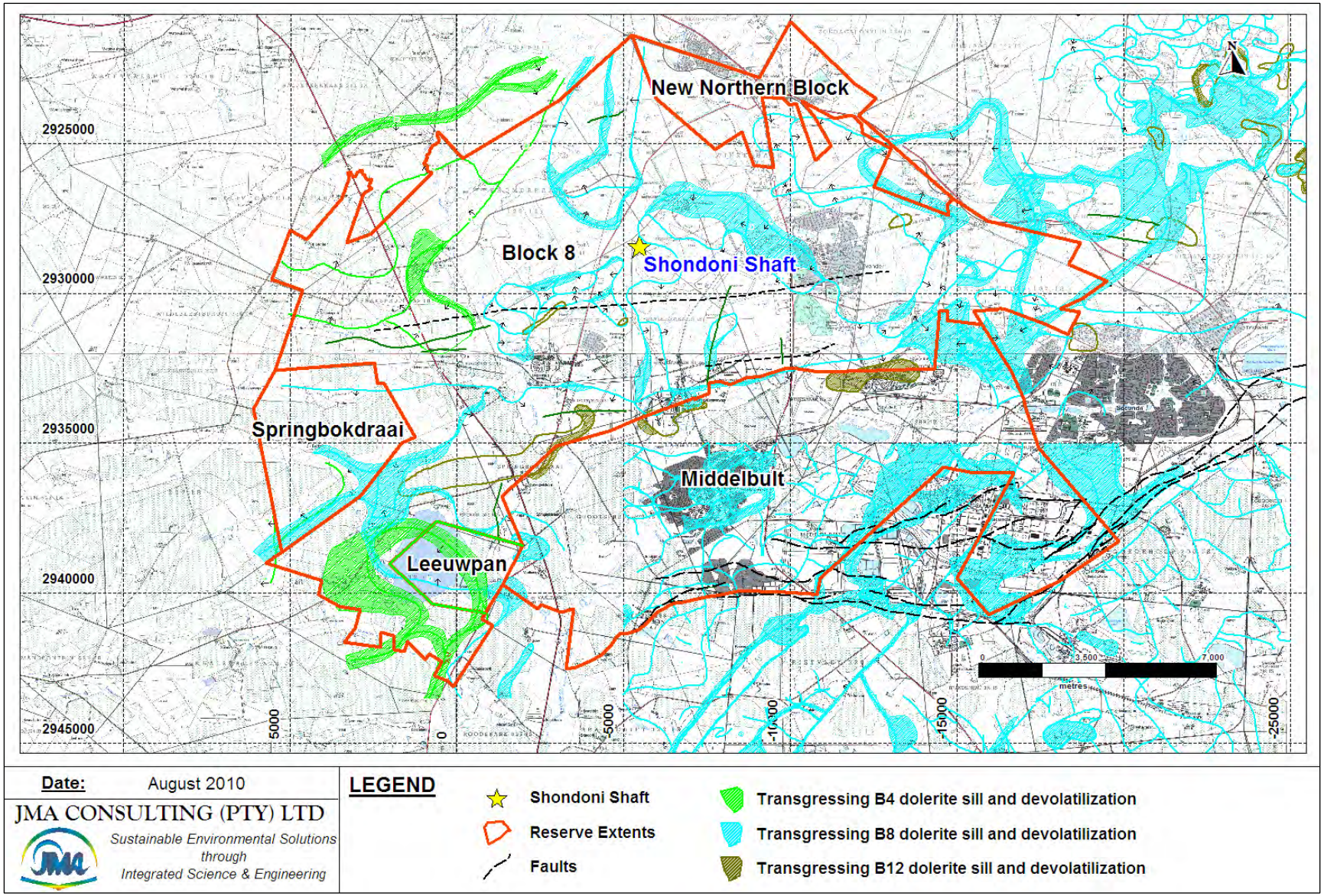


Figure 5.5.3(g): Major Secondary Geological Structures within the Study Area

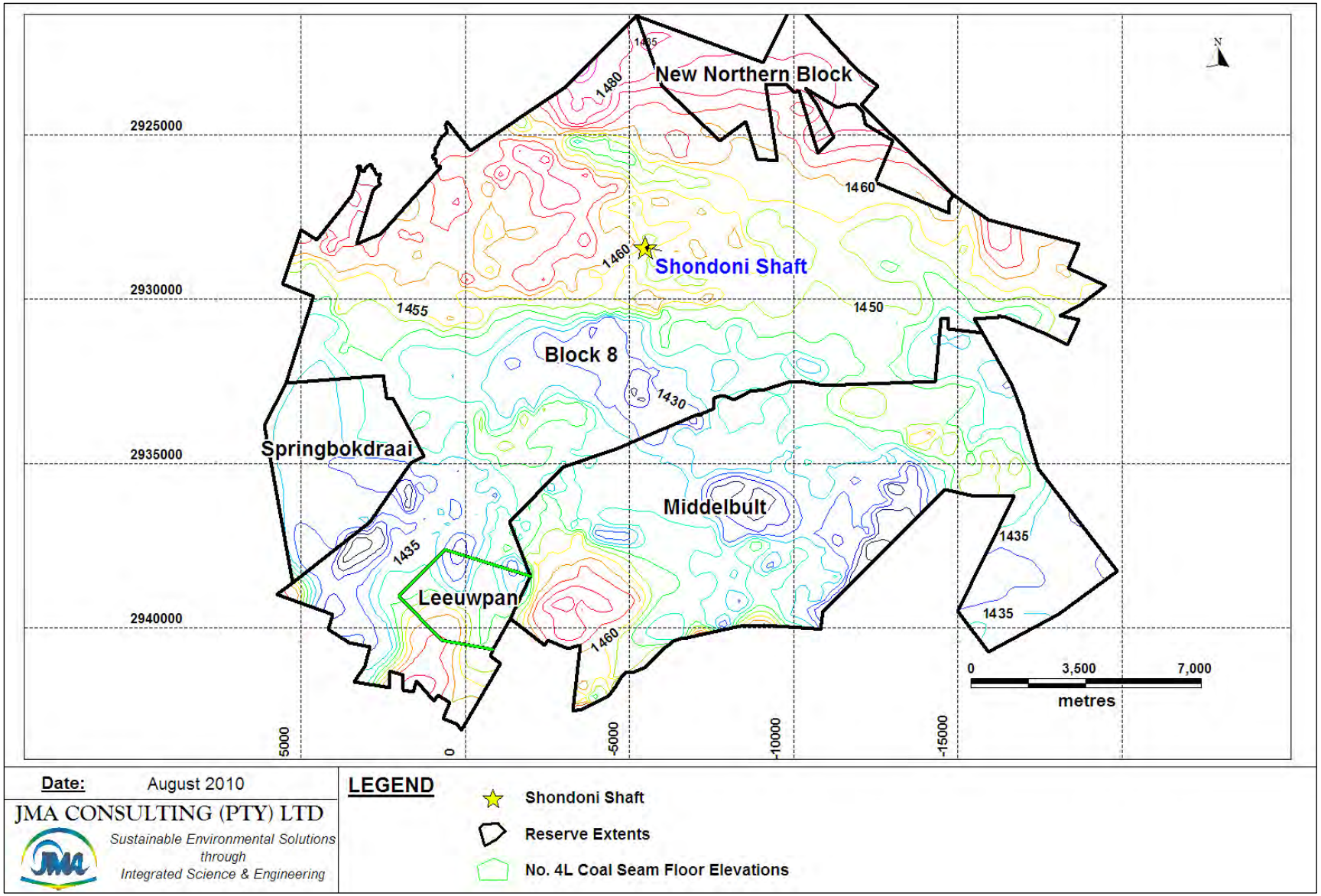


Figure 5.5.3(h): Interpolated Elevation Distribution of the No. 4L Coal Seam Floor

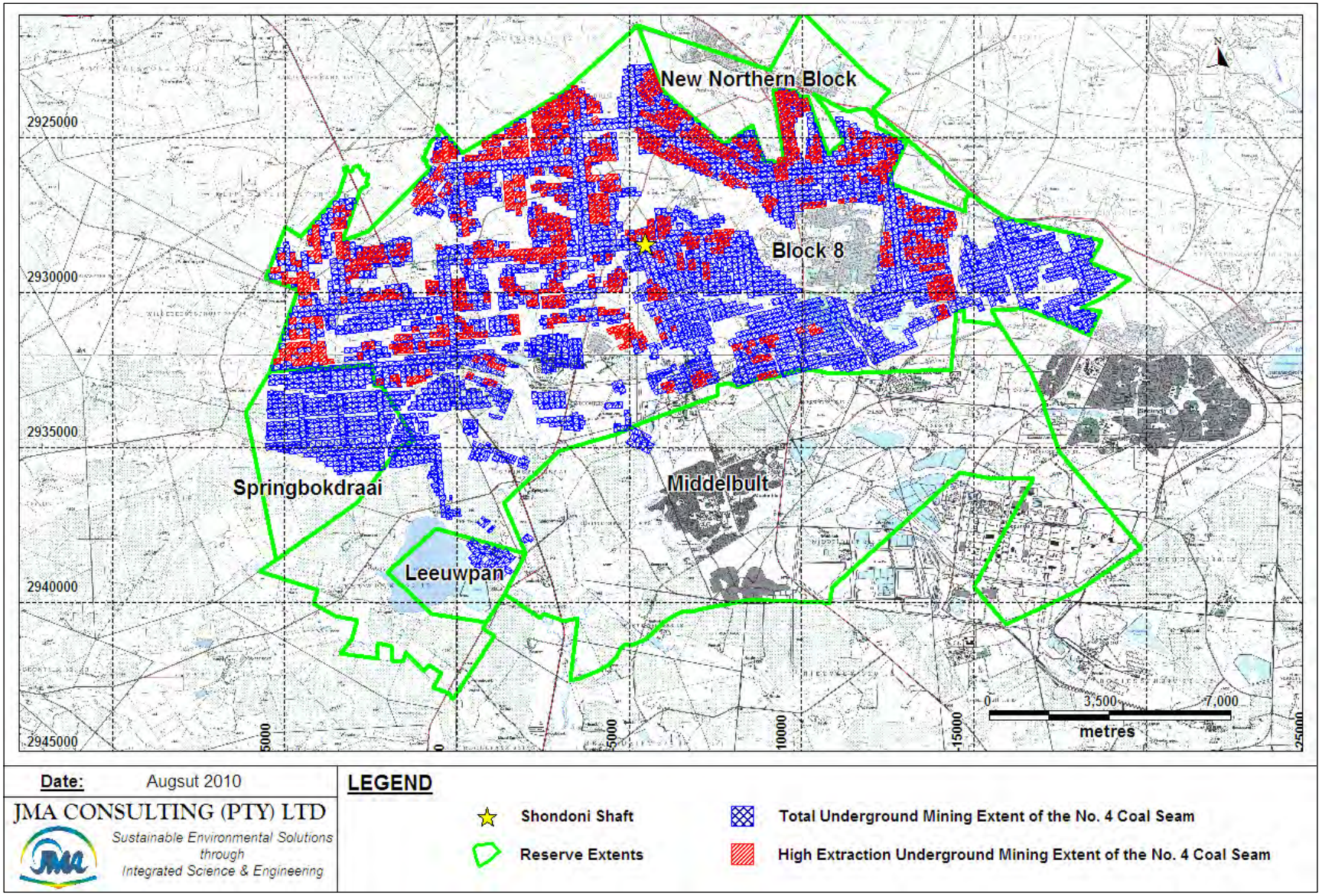


Figure 5.5.3(i): Proposed Underground Mining Extent and Layout of the No. 4 Coal Seam

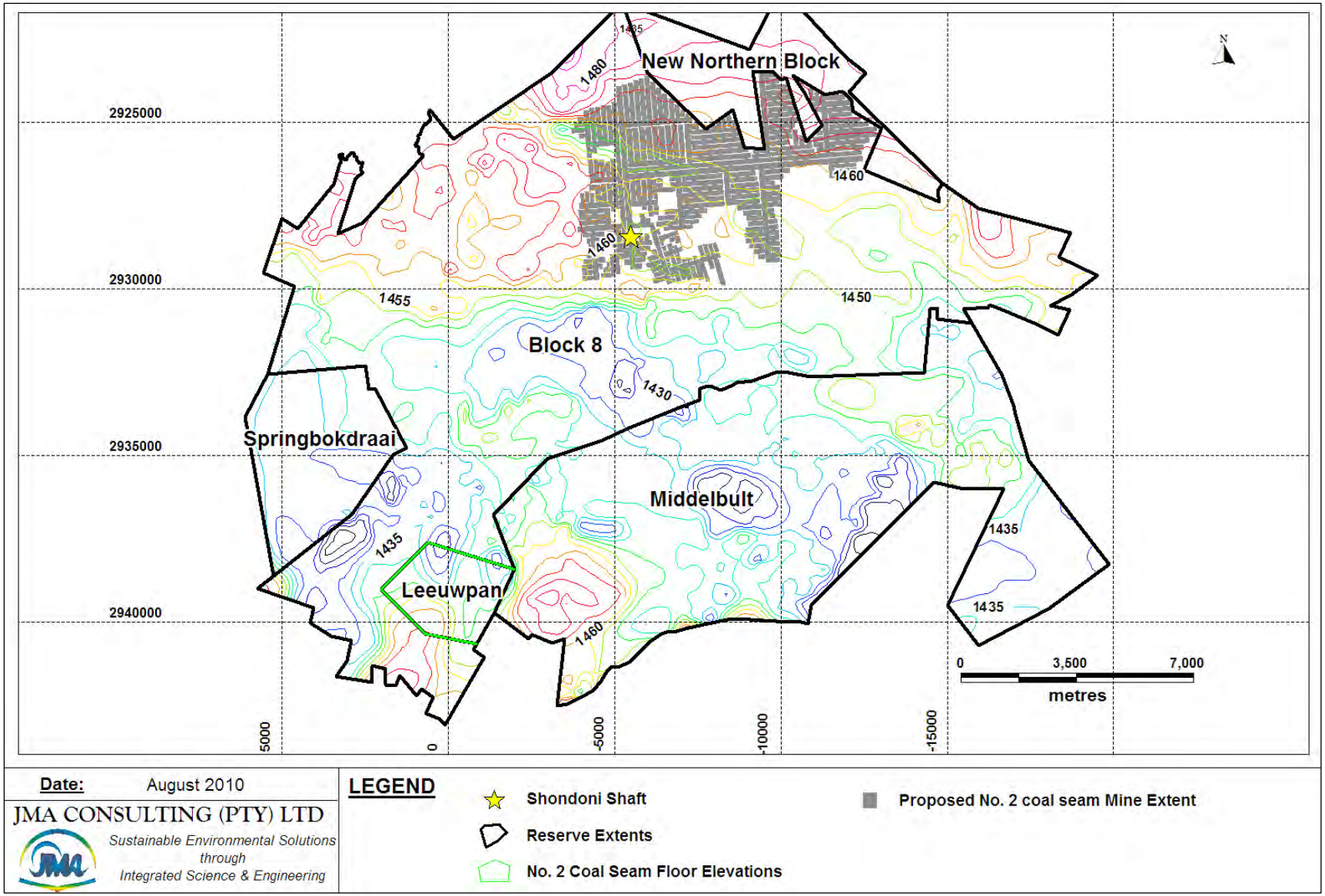


Figure 5.5.3(j): Interpolated Elevation Distribution of the No.2 Coal Seam Floor

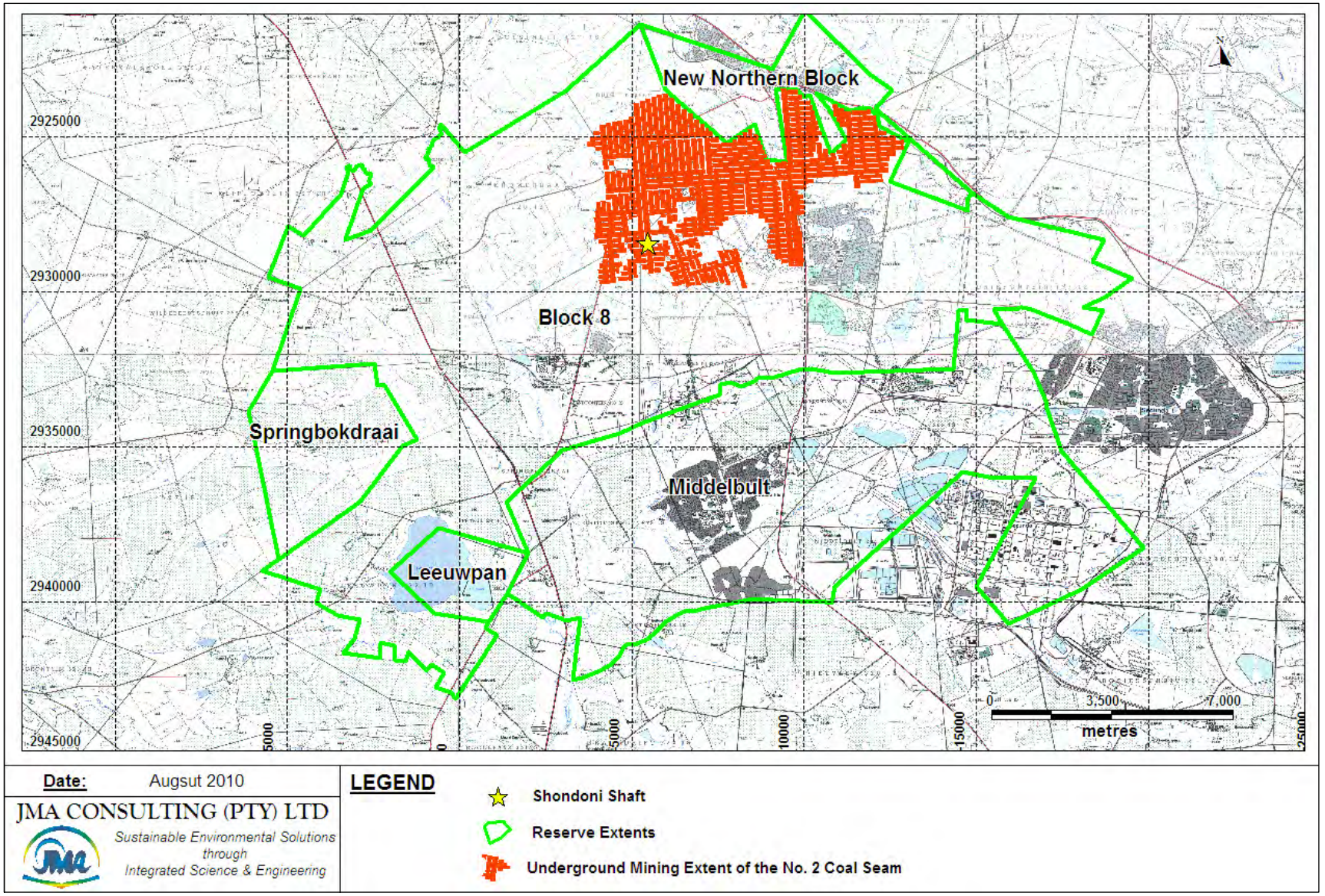


Figure 5.5.3(k): Proposed Underground Mining Extent and Layout of the No. 2 Coal Seam

5.5.3.1 Lithology and Stratigraphy

The geology of the study area comprises mainly of sedimentary lithologies, belonging to the Karoo Supergroup, particularly, sandstone and sand/siltstone intervals of the Vryheid Formation, which rests unconformably on a (pre-Karoo) gabbro basement.

The general lithological profile of the study area, up to, and including the No. 2 coal seam, comprises of:

- Soft overburden consisting of soils and weathered sandstone and some occasional highly weathered dolerite
- Hard overburden consisting of fresh to slightly weathered dolerite, sandstone and shale units
- No.5 coal seam (only present in some areas)
- Inter burden units of sandstone
- No.4H and/or 4L coal seam with a thin layer of sandstone in between if both are present
- Karoo Sediments
- No. 2 coal seam

Dolerite dykes and sills also appear unconformably across the study area.

The No. 4L coal seam floor elevations are depicted in Figure 5.5.3(h), whilst the No. 2 coal seam floor elevations are depicted in Figure 5.5.3(j). The No. 4L seam ranges in elevation between 1436.20 mamsl and 1527.14 mamsl with an average elevation of 1483.43 mamsl. The No. 2 seam occurs some 20 to 30 meters below the No. 4L seam and ranges in elevation between 1408.98 m amsl and 1493.50 mamsl with an average elevation of 1449.734 mamsl.

The No. 4L coal seam has the highest elevations within the new Block 8 Northern Reserve, and becomes progressively lower towards the South across the Block 8 and Springbokdraai Reserves. The No. 4L coal seam is the deepest across the southern as well as south-western extent of the Block 8 Reserve. The No. 4L coal seam has a high lying area across the south-western corner of the Middelbult Reserve, whilst the central parts of the Middelbult Reserve has the lowest No. 4L coal seam elevations.

The No. 2 coal seam floor elevation contours across the study area depicts a similar pattern as the No. 4L coal seam floor elevations contours. The No. 2 coal seam has the highest elevations across the northern extent of the Block 8 Reserve as well as the new Block 8 Northern Reserve. The No. 2 coal seam floor elevations become progressively lower towards to the south, across the extent of the Block 8 Reserve. The lowest elevations occur across the south-western extent of the Block 8 reserve, the Springbokdraai Reserve as well as the central areas of the Middelbult reserve. The No. 2 coal seam elevation becomes progressively higher across the south-western corner of Middelbult Reserve up to an elevation of 1475 mamsl.

The proposed underground mining extent of the No. 2 coal seam is depicted in gray on Figure 5.5.3(j). The No. 2 coal seam across this extent ranges in elevation between 1448 mamsl and 1477 mamsl. The lie of the No. 2 coal seam across this extent is very similar to the No. 4L coal seam as well and is the highest across the northern extent of the Block 8 Reserve. The coal seam becomes progressively lower towards the southern and south-eastern extent of the proposed underground mine extent. The interpolated No. 2 coal seam elevation below the surface location of the Shondoni Shaft is ± 1450 m amsl, whilst the No. 4L coal seam elevation at the same point is ±1485 mamsl.

It should be remembered that the floor contour elevations have been interpolated using the Kriging method, and the floor elevations do therefore indicate the effects of faulting.

The coal seams have been displaced and devolatilized to varying degrees as a result of the tectonics and intrusives within the study area. The locations of the dolerite intrusions as well as the extents of devolatilization of the No. 4 coal seam associated with the intrusives are delineated on Figure 5.5.3(g). The displacement of the coal seams as a result of the dolerite intrusions, generally ranges from no displacement to not much more than the than the coal seam thickness itself. There is however a displacement of roughly 35 *m*, almost equal to the thickness of the transgressing and troughing B 4 sill, compartmentalizing the southern-most portion of the reserve on Leeuwpan 532 IR, and is indicated on cross-section NS1 shown in Figure 5.5.3(b).

The Block 8 underground reserve is largely separated from the existing Middelbult Colliery, compartmentalized and sub-compartmentalized by a ± 15 *m* thick southwest-northeast B8 dolerite sill (Figure 5.5.3(f)). The sill underlies the Middelbult Colliery, close to the floor of the Karoo sediments before bending upwards to the vertical again, transgressing the coal seams before surfacing on Zandfontein 130 IS. Centrally from Zandfontein 130 IS, to both the east and the west this sill has numerous sub-vertical split-offs, which join up and split off again.

On the farm Springbokdraai 591 IR the ± 15 *m* thick B8 dolerite sill splits into two sills 12 *m* and 3 *m* in thickness respectively. The larger sill is placed underneath the coal seams, close to the floor of the Karoo sediments, before bending sub-vertically upwards to transgress the coal seams and compartmentalize a large portion of the reserve underlying Rietkuil 591 IR.

The No. 4L coal seam floor elevation pertaining to this compartment, slopes from an elevation ranging between 1470 *mamsl* and 1465 *mamsl* along the sub-vertical 12 *m* thick B8 dolerite sill in the north, to an elevation of 1450 *mamsl* along the sub-vertical 3 *m* off-shoot in the south. The eastern off-shoot forms the western boundary of the larger Middelbult Colliery compartment while the western off-shoot forms the eastern boundary of the compartment.

The NS1 geological cross-section and Figure 5.5.3(a) indicate that the ± 15 *m* thick B8 dolerite sill originates from an 18 *m* thick sill dipping from above the 4L coal seam to the north on Leeupan 532 IR to transgress the seams on its way down before bending to the horizontal below the coal seams to attenuate to the north.

On its way down this B8 sill also intersects a 30 *m* thick transgressing B4 dolerite sill that troughs most of Leeupan. Some 1 *km* west of Leeupan the 18 *m* thick sill splits into two sills respectively 15 *m* and 3 *m* in thickness. The No. 4L coal seam floor elevation pertaining to this compartment, slopes from a high of 1525 *mamsl* in the south-east to a low of 1450 *mamsl* in the far north-west, before rising again to an elevation of 1465 *mamsl* in the north-western corner of this compartment.

The larger Middelbult Colliery compartment is of particular significance, as a sizable portion of the proposed Block 8 mine layout, including the proposed brown field accesses from Middelbult Colliery, falls within this compartment. Of significance is the fact that both the Leslie Gold Mines Ltd and Winkelhaak slimes dams are located in this area. Some existing high extraction mining panels occur as close as 20-50 *m* to the west of the south-western corner of the Leslie Gold Mines Ltd slimes dam and 80-100 *m* to the east of the Winkelhaak slimes dam. Manifested impacts relating to the de-watering of the shallow weathered zone aquifer(s) over some of Middelbult Colliery's high extraction panels have already been observed in some of the SSF monitoring boreholes.

The portion of the proposed mine layout underlying the south-western corner of Rietkuil 531 is compartmentalized by the ± 15 *m* thick B8 dolerite sill that splits off the larger 18 *m* sill some 1 *km* west of Leeupan and bends backward to the south-west. This area is further sub-compartmentalized by a 45 *m* thick B4 dolerite sill that splits into two smaller sills respectively 38 *m* and 7 *m* in thickness. The No. 4 L coal seam floor elevation appears to slope towards the north-eastern corner of this compartment to a low of 1450 *mamsl*.

Both to the east of Evander on Leeuwspruit 134 IS and Winkelhaak 134 IS and to the north of Evander on Kinross 133 IS and Winkelhaak 134 IS various off-shoots varying in thickness between 1 *m* and 4 *m* further sub-compartmentalize the two larger sub-compartments to this compartment.

Apart from the portions of the Block 8 reserve separated from Middelbult Colliery, compartmentalized and sub-compartmentalized by transgressing B8 dolerite sills, the north-western portion of the reserve with specific reference to the cadastral farms Salpeterkranz 128 IS, Rolspruit 127 IS, Klipfontein 357 IR, Brakspruit 359 IR and Kromdraai 128 IS, is further compartmentalized by a 20 *m* thick transgressing B4 dolerite sill.

5.5.3.2 Weathering Profile

The limit of weathering as well as the total overburden depths of the study area was determined from the exploration boreholes as recorded by Sasol's Geology Division and is summarized in Table 5.5.3.2(a).

Table 5.5.3.2(a): Summary of the Limit of Weathering and Overburden Depths

Description	Value	
Soft soil overburden thickness (*m*)	Min.	1.42
	Max.	23.32
	Ave.	**6.44**
Weathering Thickness (*m*) *(Highly weathered zone, followed by a slightly weathered/fractured zone)*	Min.	9.14
	Max.	33.56
	Ave.	**15.27**
Total Overburden from surface to the No.5 coal seam – where present (*m*)	Min.	0.00
	Max.	135.55
	Ave.	**76.17**
Total Overburden from surface to the No.4L coal seam (*m*)	Min.	16.95
	Max.	182.40
	Ave.	**108.54**
Total Overburden from surface to the floor of the Karoo Sediments (*m*)	Min.	91.28
	Max.	256.73
	Ave.	**182.87**

Table 5.5.3.2(a) indicates that the study area has an average overburden (soil) thickness of 6.44 metres, and ranges in thickness from 1.42 meters to 23.32 meters. The soil is predominantly underlain by a highly weathered zone, followed by a slightly weathered to fractured zone. The weathered zone consists of soft overburden, weathered sandstone and some occasional weathered dolerite. The overburden becomes progressively harder and consists of more fractured to slightly weathered dolerite, sandstone and shale units. The total weathering thickness across the study area ranges between 9.14 m and 33.56 m, with an average thickness of 15.27 m across the extent of the study area.

The depth to the No. 5 coal seam ranges between 0 meters (where it outcrops at the surface) and a maximum depth of 135.55 meters below the surface. The No. 5 coal seam lies at an average depth of 76.17 meters below the surface level, across the extent of the study area. The No. 4 coal seam lies at a greater depth and is a lot more extensive than the No. 5 coal seam within the study area. The No. 4L coal seam ranges in depth from 16.95 m to 182.40 m below the surface, with an average depth of 108.54 m below the surface. The No. 4L coal seam is underlain and predominantly separated from the No. 2 by the Karroo Sediments.

The base of the Karoo consists of tillite overlain by sandstone and siltstone of the Pietermaritzburg Formation, which is in turn overlain by sediments from the Vryheid Formation.

5.5.3.3 Dykes and Faults

Analyses of the geological database and cross sections provided by the Sasol Mining Geology Division in terms of the physical properties of the B4 intersections, indicated an area along the central southern bounds of the Block 8 reserve, neighboured by the Middelbult Mine, to be overlain by a fairly jointed B4 sill. This area also co-insides with the proposed brown field access to the reserve from the Middelbult Mine. Seventy-three (73) jointed intersections were recorded at intervals ranging in depth between 2 m and 50 m. The average depth of these intersections ranged between 13 m and 30 m. The thickness of these intervals ranged between 1 m and 26 m and averaged at 16 m. Some semi-vertical jointed intersections and double-jointed contacts were also noted.

Additionally, a number of joints and faults were recorded below the overlying B4, including the No. 4L coal seam horizon, while 3 boreholes intersected brecciated contacts along a siltstone interval. Another nine regional fault contacts along sandstone intervals were recorded, while three boreholes intersected fault contacts along the No. 4L coal seam horizon at depths ranging between 65 m and 67 m.

The dolerite occurrences in the area, have specific significance with regard to the geohydrology of the study area. Not only can ground water compartments exist as a result of these features, but the possible ground water interaction between mines, will also be a function of the dolerite distribution. It is important that an over-simplification of the compartmentalization of the mining sections not be adopted for geohydrological purposes. Compartmentalization of the coal reserves, on the coal seam horizon, as it relates to mining activities, does not necessarily imply a ground water compartment for the aquifer(s).

Dykes

The Karoo sediments were displaced by two phases of post-Karoo dolerite intrusions. The oldest, namely the B4 dolerite intrusions, are fine to medium crystalline dolerite, typically occurs as a massive sill, is mostly restricted to the surface and has a maximum thickness of ± 49 *m.* This sill is eroded away in the lower lying areas. Locally the B4 dolerite is not only surface bound, but transgresses the coal seams in a rough-like fashion to effectively compartmentalize these portions of the reserve on the mining horizon as indicated on Figure 5.5.3(g).

The B6 dolerite is a porphyritic dolerite, usually 3 m thick and intersects the coal seams less frequently than the B8 dolerite. Out of 615 exploration boreholes only one intersection was noted.

The B8 dolerite is a fine grained porphyritic dolerite and intruded later than the B4 dolerites. The B8 dolerite intruded along semi-planar features, with the result that it is mainly exposed as dykes, i.e. almost vertical intrusives. The B8 ranges in thickness from very thin to a maximum of 18 m. The prominent, east-west striking dyke or sub-vertical sill, separating most of the Block 8 reserve from Middelbult Colliery (Figure 5.5.3(g)), can be seen to range in thickness between 7 m and 15 m.

The B8 sill dolerite, ± 18 m in thickness, features near vertical off-shoots (dykes), where it transfers from one horizontal plane to another. These features occur predominantly along the planes of transference. This phenomenon results in extensive geological compartmentalization observed across the study area.

The B12 dolerite is a light grey, fine-grained porphyritic dolerite with large needle-like phenocrysts, roughly ranging in thickness between 0,12 *m* and 0,75 *m*. The B12 dolerite does not intersect the No. 4L seam as abundantly as the B4 or B8 dolerite intrusions (Figure 5.5.3(g)).

Twenty-three dolerite intersections were recorded in twenty of the newly drilled monitoring boreholes. Thirteen water strikes, associated with host rock contacts as well as the contact between weathered and fresh dolerite, were recorded along these intersections.

Faults

In the central portion of the study area two normal faults of significance occur. The larger of the two faults has a throw of 15 m to the south, the dip also being to the south. This fault has a east-west strike and stretches between Brandspruit 359 IR in the west and the town of Evander in the east, over a distance of 15,5 km, intersecting the Kinross Mines Ltd Slimes Dams to the west of Evander. (Figure 5.5.3(g)).

This fault zone was intersected in boreholes SSW-7, SDF-7 and SDF-10. Major water strikes were encountered in boreholes SSW-7 and SDF-7, both located some 800 m west of the Kinross Mines Ltd Slimes Dams. Borehole SSW-7 intersected large calcified fracture planes with pyrite mineralisation, yielding water make of ± 22 l/s, in the overlying B4 dolerite at a depth of 17-18 m. Borehole SDF-7, situated some 10 m south of borehole SSW-7, recorded a water strike of ± 19 l/s, also at a depth of 17-18 m in a highly fractured B4 dolerite (no calcification observed), and a further ± 10 l/s at a depth of 41-43 m, along a fracture in a fresh sandstone/shale succession. The strike of this fault zone beyond the property boundary has not been confirmed.

The smaller fault situated some 2 km south of the larger fault to the south of Kinross Mines Ltd, has a throw of 9 m to the north on the No.4L seam, the dip also being to the north. As with the larger fault, the strike is also east-west in orientation. It stretches between Witkleifontein 131 IS in the west and between Evander's Sewage Works and the Winkelhaak Mines Slimes Dams in the east, over a distance of 4 km. The strike of this fault zone beyond the property boundary has also not been confirmed.

5.5.3.4 Mineralogy and Geochemistry

The mineralogy and geochemistry of the geological units up to the No. 2 coal seam was determined. Due to the limited depth to which the boreholes were drilled, mineralogy and geochemical analysis of the No. 2 seam could therefore not be conducted.

Acid Base Accounting

The determination of the acidification potential of overlying geological units gives an indication of the long-term impact on water quality entering mine workings. The same level of oxidation as found in spoils of a strip mine will, however, not take place in disturbed stratigraphical units above underground workings. It is important to semi-quantitatively identify the geochemical nature of stratigraphical units and its influence on the long-term quality of water in mined-out horizons, in case acidification takes place, due to dewatering and subsequent oxygen ingress in overlying stratigraphical units.

Acid Base Accounting (ABA) and various leaching tests were performed on 20 samples, using the Modified Sobek (Lawrence) Method. Based on the results of the ABA and leaching tests, the following conclusions can be reached in regard to the overall acid generating potential of stratigraphical units above the No.4L coal seam:

- Paste pH levels measured indicate the presence of either excess base or acid material in stratigraphical units for the current (in-situ) situation. None of the samples had paste (initial) pH-levels of lower than 7.77. This is an indication of the excess base material present in the stratigraphical units at this stage. The ground water draining initially into the underground workings will display the effects of this excess base material, in the form of elevated Alkalinity values.

- A total S % calculation usually gives an indication of the sum-total of all sulphur species present in the rock. This figure might include an entire range of sulphate species, sulfide species, and organic sulphur species, some of which are only partly, or not oxidizable at all. The total S calculated for Middelbult Block 8 does not give an overestimation of the material available for oxidation, since only the reactive components were measured.

- The range in total S % of all of the lithologies is relatively big (0.001% - 2.271%), with an average value of 0.370%. This is an indication of the heterogeneity in terms of pyrite mineralisation and distribution in the different stratigraphic units.

- The Acid Generation Potential (AP) gives an indication of the gross potential for acidification per volume material. The range in AP is between 0.031 kg/t $CaCO_3$ and 70.969 kg/t $CaCO_3$, with an average value of 11.573 kg/t $CaCO_3$. A number of 5 samples (25%) showed elevated values above the average.

- The Neutralization Potential (NP) gives an indication of the total base potential available to neutralize acidification. The range in NP is between 5.5 kg/t $CaCO_3$ and 62.5 kg/t $CaCO_3$, with an average value of 18.3 kg/t $CaCO_3$. A number of 8 samples (40%) showed elevated values above the average. The average value for all the samples is higher than the values recorded for the Acid Generation Potential (AP).

- The Nett Neutralization Potential (NNP) is the total of NP - AP. A positive value means excess base potential, a negative value excess acid potential. The range in NNP is between –58.5 kg/t $CaCO_3$ and 62.5 kg/t $CaCO_3$, with an average value of 6.8 kg/t $CaCO_3$. Overall a positive NNP is present. The very large range in NNP indicates the heterogeneity in the different stratigraphical (geochemical) units.

- The AP:NP Ratio and Rock Type columns are semi-quantitative methods of characterizing different potential acid-generating materials. The modified classification is shown in Table 5.5.3.4(a).

Table 5.5.3.4(a): Modified Classification of Stratigraphical Units in Terms of Acid Base Accounting (ABA)

Rock Type	Acid Forming Potential	Comments
Type I	Potentially Acid Forming	Total S (%) > 0.25% and AP:NP ratio 1:1 or less
Type II	Intermediate	Total S (%) > 0.25% and AP:NP ratio 1:4 or less
Type III	Non-Acid Forming	Total S (%) < 0.25% and AP:NP ratio 1:4 or greater

- The results of the ABA and leaching tests conducted on the 20 samples, indicates that mixture of rock types are present, namely;

  - 3 x Type I samples
  - 6 x Type II samples, and
  - 11 x Type III samples

- This again indicates the heterogeneity of the samples.

Geochemical Sampling

Care was taken during the sampling procedure to ensure that representative geochemical samples were taken at each borehole. The following geochemical units were identified (up to a limited depth) within the study area:

- Grey, weathered mudstone (directly beneath the soil profile),
- Light-gray, fine-grained, massive sandstone,
- Gray to dark-gray sandstone and shale (carbonaceous and micaceous),
- No. 4L coal seam,
- No. 4H coal seam, and
- No.5 coal seam.

The in-situ geochemical characteristics of the 6 units identified are summarized in Table 5.5.3.4(b):

Table 5.5.3.4(b): In-Situ Geochemical Characteristic Summary of the 6 Identified Units.

Geochemical Unit		Total % S	NP (kg/t)	AP (kg/t)	NNP (kg/t)	Ratio NP:AP
Gray, weathered mudstone	Min.	0.001	5.75	0.03	5.72	184
	Max.	0.001	5.75	0.03	5.72	184
	Ave.	0.001	5.75	0.03	5.72	184
Light-gray, fine-grained massive sandstone	Min.	0.001	5.50	0.031	5.156	3.3
	Max.	0.189	62.50	5.906	62.469	2000
	Ave.	0.058	20.47	1.80	18.67	236
Gray to dark-gray sandstone and shale	Min.	0.021	9.75	0.656	7.938	2.1
	Max.	0.226	15.00	7.063	9.094	14.8
	Ave.	0.124	12.38	3.86	8.52	8.5
No.5 coal seam	Min.	0.273	10.25	8.53	1.72	1.2
	Max.	0.273	10.25	8.53	1.72	1.2
	Ave.	0.396	16.88	12.36	4.52	1.3
No. 4H coal seam	Min.	1.527	10.25	47.72	-58.47	0.2
	Max.	2.271	12.50	70.97	-37.47	0.2
	Ave.	1.899	11.38	59.34	-47.97	0.2
No. 4L coal seam	Min.	0.547	27.50	17.09	-2.84	0.9
	Max.	1.043	29.75	32.59	10.41	1.6
	Ave.	0.795	28.63	24.84	3.78	1.3

Based on the ABA results and those indicated in Table 5.5.3.4(a), the following conclusions are made with regards to the different lithological units:

<u>Gray, Weathered Mudstone</u>

- The average %S is very low and thus also the AP. This can be attributed to the leaching of all S in the geological past.
- The NP is also low in the mudstone, though still very higher than the AP, giving rise to a big neutralizing ratio.
- The thickness of soil (soft overburden) at borehole SDF-14 is very thin over the mudstone, 1m. The overburden is also very clayey, indicating that it originates from the mudstone. The mudstone itself is weathered and situated above the water table.
- The low NP and even lower AP are probably naturally lower in the mudstone (due to the geochemical environment and type of sediments during deposition) but weathering has definitely contributed to a low AP and NP.

<u>Light-Gray, Fine-Grained, Massive Sandstone</u>

- This light coloured unit is present throughout the lithological profile. In the boreholes it also occurs at different depths with shallower and deeper sandstones that show the same physical characteristics (colour, texture, grain size).

- The average %S and AP varies and AP ranges from 0.031 to 5.961 kg/t but it is still substantially lower than the NP. This unit has the highest NP and NNP values of all the geochemical units sampled.

- There is a complex variation of AP and NP between the different sandstones both laterally and vertically. The AP:NP ratio ranges from 1:3.3 to 1:2000, but always keep higher than 1:3, potentially indicating a non-acid forming rock in all the samples.

- A substantial part of the overall neutralisation potential at Middelbult Block 8 is present in these units.

Grey to Dark-Gray Sandstone and Shale

- This darker coloured unit is present throughout the lithological profile. The darker colour indicates some organic material showing that deposition of these sedimentary rocks took place in a more anoxic environment than the environment of deposition of the mudstone and sandstone units discussed above.

- The average %S is slightly higher than in the above sandstone units as can be expected and likewise the AP. The NP is lower than that of the sandstone units but still much higher than the AP.

- The NP:AP ratio is more than 1:1 indicating an intermediate rock with a positive NNP.

Coal Seams No's. 4L, 4H & 5

- Coal seams forms due to the accumulation of organic matter in an anoxic geochemistry environment. If sulphur and iron is present in an anoxic environment pyrite will form. The coal seams will thus show a higher AP than the units discussed above.

- The average %S is higher, as are expected. The NP is lower than the AP.

- Interesting are the differences between the coal seams that indicates some small differences in environmental conditions during deposition. More %S are present in the No.4 coal seams than in No.5 and more in No.4H than in No.4L which led to differences in AP.

- The NP:AP ratio is less than 1:3 for the different coal seams indicating an intermediate to acid forming rock. Coal seam No.4H show in all the samples much more potential for acid forming followed by No.4L and then No.5.