Applicant: Impala Platinum Limited (Rustenburg Operations)

DMR Reference Number: NW30/5/1/2/2/131 and 133MR

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED SHAFT 16 WASTE ROCK DUMP EXPANSION AND OPENCAST ACTIVITIES AT PIT8C

JANUARY 2013

SUBMITTED IN SUPPORT OF EXISTING MINING RIGHTS IN TERMS OF SECTION 39 AND OF REGULATIONS 50 AND 51 OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT NO. 28 OF 2002) (the Act)

DOCUMENT INFORMATION

Title	ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED SHAFT 16 WASTE ROCK DUMP EXPANSION AND OPENCAST ACTIVITIES AT PIT8C
Project Manager	Caitlin Pringle
Author	Caitlin Pringle
Reviewer	B Stobart
Client	Impala Platinum Limited
Date last printed	04/02/2013 09:24:00 AM
Date last saved	04/02/2013 09:24:00 AM
Comments	
Keywords	Environmental Impact assessment, Environmental Management Programme, Shaft 16 waste rock dump, Pit8C, opencast, North West Province
Project Number	710.09003.00092
Report Number	1
Status	Final
Issue Date	January 2013

SLR OFFICES	
Johannesburg, South Africa Physical Address: SLR Fourways Manor Office Park Corner Roos and Macbeth Streets Fourways Johannesburg South Africa Postal Address: P O Box 1596 Cramerview 2060 Tel: +27 (011) 467-0945 Fax: +27 (011) 467-0978	Pretoria, South Africa Physical Address: Atterbury Estate Office Park Block 7, First floor 19 Frikkie de Beer Street Menlyn 0181 Postal Address: P O Box 40161 Faerie Glen 0043 Tel: +27 (012) 361-8118 Fax: +27 (012) 361-3859

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED SHAFT 16 WASTE ROCK DUMP EXPANSION AND OPENCAST ACTIVITIES AT PIT8C

CONTENTS

EXECUTIVE SUMMARY I
INTRODUCTION I
SECTION 1 – ENVIRONMENTAL IMPACT ASSESSMENT I
1 DESCRIPTION OF THE BASELINE ENVIRONMENT 1-1
1.1 ON-SITE ENVIRONMENT RELATIVE TO SURROUNDING AREA 1-1
1.1.1 GEOLOGY BASELINE 1-1
1.1.2 CLIMATE BASELINE 1-6
1.1.3 TOPOGRAPHY BASELINE 1-9
1.1.4 SOIL BASELINE 1-10
1.1.5 LAND CAPABILITY BASELINE 1-16
1.1.6 BIODIVERSITY BASELINE 1-17
1.1.7 SURFACE WATER BASELINE 1-26
1.1.8 GROUNDWATER BASELINE 1-33
1.1.9 AIR QUALITY BASELINE 1-38
1.1.10 NOISE 1-45
1.1.11 VISUAL LANDSCAPE 1-47
1.2 ENVIRONMENTAL ASPECTS WHICH MAY REQUIRE PROTECTION OR REMEDIATION 1-48
1.3 LAND USES, CULTURAL AND HERITAGE ASPECTS AND INFRASTRUCTURE 1-49
1.3.1 CULTURAL ASPECTS 1-49
1.3.2 HERITAGE BASELINE (INCLUDING CULTURAL RESOURCES) 1-49
1.3.3 SOCIO-ECONOMIC 1-50
1.3.4 LAND USES 1-55
1.4 MAPS SHOWING THE SPATIAL LOCALITY AND AERIAL EXTENT OF ENVIRONMENTAL FEATURES 1-60
2 PROPOSED OPENCAST MINING AND WRD EXPANSION PROJECTS 2-1
2.1 MINERAL TO BE MINED 2-1
2.2 MINING METHOD TO BE EMPLOYED 2-2
2.2.1 PROPOSED PIT8C PROJECT 2-2
2.3 LIST OF MAIN ACTIONS/ACTIVITIES/PROCESSES 2-4
2.4 PLAN SHOWING LOCATION AND EXTENT OF OPERATIONS 2-13
2.4.1 PIT8C PROJECT 2-13
2.4.2 SHAFT 16 WRD EXPANSION 2-13
2.5 LISTED ACTIVITIES IN TERMS OF NEMA EIA REGULATIONS 2-16
2.6 INDICATION OF PHASES AND TIMEFRAMES ASSOCIATED WITH THE MAIN ACTIONS/ ACTIVITIES/ PROCESSES 2-16
2.7 ADDITIONAL INFORMATION 2-17
2.7.1 CONSTRUCTION PHASE 2-17
2.7.2 OPERATIONAL PHASE 2-19
2.7.3 DECOMMISSIONING PHASE 2-27
2.7.4 CLOSURE PHASE 2-28
2.8 PROJECT ALTERNATIVES 2-28
2.8.1 SITE SELECTION 2-28
2.8.2 TECHNOLOGY ALTERNATIVES 2-30
2.8.3 THE "NO PROJECT" OPTION 2-30
3 POTENTIAL IMPACTS 3-1
3.1 LIST OF POTENTIAL IMPACTS ON ENVIRONMENTAL ASPECTS 3-1
3.2 LIST OF POTENTIAL CUMULATIVE IMPACTS 3-3
3.3 POTENTIAL FOR ACID MINE DRAINAGE OR GROUNDWATER CONTAMINATION 3-4
4 ALTERNATIVE LAND USE OR DEVELOPMENT 4-1
4.1 DESCRIPTION OF ALTERNATIVE LAND USE OF THE AREA 4-1
4.2 MAIN FEATURES AND INFRASTRUCTURE RELATED TO ALTERNATIVE LAND USE / DEVELOPMENT 4-1

4.3 PLAN SHOWING LOCATION AND EXTENT OF ALTERNATIVE LAND USE / DEVELOPMENT 4-1
5 POTENTIAL IMPACTS OF ALTERNATIVE LAND USE OR DEVELOPMENT 5-1
5.1 LIST OF POTENTIAL IMPACTS 5-1
5.2 LIST OF POTENTIAL CUMULATIVE IMPACTS 5-1
6 POTENTIAL SOCIAL AND CULTURAL IMPACTS 6-1
6.1 LIST OF POTENTIAL IMPACTS ON SOCIO-ECONOMIC CONDITIONS OF THIRD PARTY LAND USE ACTIVITIES 6-1
6.2 CULTURAL ASPECTS AND POTENTIAL IMPACTS THEREON 6-1
6.3 HERITAGE FEATURES AND POTENTIAL IMPACTS THEREON 6-1
6.3.1 HERITAGE (AND CULTURAL) FEATURES 6-1
6.3.2 PALAEONTOLOGICAL FEATURES 6-1
6.4 QUANTIFICATION OF IMPACTS ON SOCIO-ECONOMIC CONDITIONS 6-1
7 ASSESSMENT AND EVALUATION OF POTENTIAL IMPACTS 7-1
7.1 LIST OF EACH POTENTIAL IMPACT 7-1
7.2 IMPACT RATING FOR EACH POTENTIAL IMPACT 7-1
7.2.1 ISSUE: LOSS AND STERILISATION OF MINERAL RESOURCE 7-2
7.2.2 ISSUE: HAZARDOUS EXCAVATIONS AND INFRASTRUCTURE 7-4
7.2.3 ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH POLLUTION 7-7
7.2.4 ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE 7-10
7.2.5 ISSUE: PHYSICAL DESTRUCTION OF BIODIVERSITY 7-15
7.2.6 ISSUE: GENERAL DISTURBANCE OF BIODIVERSITY 7-18
7.2.7 ISSUE: POLLUTION OF SURFACE WATER RESOURCES 7-21
7.2.8 ISSUE: ALTERATION OF NATURAL DRAINAGE PATTERNS 7-24
7.2.9 ISSUE: CONTAMINATION OF GROUNDWATER 7-27
7.2.10 ISSUE: DEWATERING 7-31
7.2.11 ISSUE: AIR POLLUTION 7-32
7.2.12 ISSUE: NOISE POLLUTION 7-36
7.2.13 ISSUE: BLASTING IMPACTS 7-39
7.2.14 ISSUE: ROAD DISTURBANCE AND TRAFFIC SAFETY 7-41
7.2.15 ISSUE: VISUAL IMPACTS 7-44
7.2.16 ISSUE: LOSS OF HERITAGE PALAEONTOLOGICAL AND CULTURAL RESOURCES 7-47
7.2.17 ISSUE: ECONOMIC IMPACT 7-47
7.2.18 ISSUE: INWARD MIGRATION 7-50
7.2.19 ISSUE: LAND USE IMPACTS 7-53
7.3 DEFINITION OF CRITERIA USED 7-56
7.4 PHASES AND TIMEFRAMES OF POTENTIAL IMPACTS 7-56
8 COMPARATIVE LAND USE ASSESSMENT 8-1
8.1 ALTERNATIVE LAND USES WHICH COULD BE IMPACTED ON 8-1
8.2 RESULTS OF SPECIALIST COMPARATIVE LAND USE ASSESSMENT 8-1
9 LIST OF SIGNIFICANT IMPACTS 9-1
10 STAKEHOLDER ENGAGEMENT PROCESS 10-1
10.1 IDENTIFICATION OF INTERESTED AND AFFECTED PARTIES 10-1
10.2 DETAILS OF ENGAGEMENT PROCESS 10-2
10.2.1 STEPS IN THE PUBLIC PARTICIPATION PROCESS 10-2
10.2.2 SPECIALIST INPUT 10-4
10.2.3 REVIEW OF EIA/EMP AMENDMENT REPORT BY IAPS 10-4
10.2.4 REVIEW OF THE EIA/EMP AMENDMENT REPORT BY REGULATORY AUTHORITIES 10-5
10.3 MANNER IN WHICH ISSUES RAISED WERE ADDRESSED 10-5
11 ADEQUACY OF PREDICTIVE METHODS AND ASSUMPTIONS AND UNCERTAINTIES 11-1
11.1 ENVIRONMENTAL ASSESSMENT LIMIT 11-1
11.2 PREDICTIVE MODELS IN GENERAL 11-1
11.3 GEOLOGY 11-1
11.4 CLIMATE 11-1
11.5 TOPOGRAPHY 11-1
11.6 LAND USE 11-1

11.7 SOILS 11-1
11.8 LAND CAPABILITY 11-1
11.9 BIODIVERSITY 11-2
11.10 SURFACE WATER 11-2
11.11 GROUNDWATER 11-2
11.12 AIR 11-2
11.13 HERITAGE AND CULTURAL RESOURCES 11-2
11.14 NOISE 11-2
11.15 BLASTING 11-2
11.16 VISUAL 11-2
11.17 SOCIO-ECONOMIC 11-2
11.18 CLOSURE COST 11-3
12 ARRANGEMENT FOR MONITORING AND MANAGEMENT OF IMPACTS 12-1
12.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES 12-1
12.2 FUNCTIONAL REQUIREMENTS OF MONITORING PROGRAMMES 12-1
12.3 ROLES AND RESPONSIBILITIES 12-2
12.4 TIMEFRAMES FOR MONITORING AND REPORTING 12-2
13 TECHNICAL SUPPORTING INFORMATION 13-1
SECTION 2 – ENVIRONMENTAL MANAGEMENT PROGRAMME II
14 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR CLOSURE 14-1
14.1 ENVIRONMENTAL ASPECTS THAT DESCRIBE THE PRE-MINING ENVIRONMENT 14-1
14.2 MEASURES TO CONTROL OR REMEDY ANY CAUSES OF POLLUTION OR DEGRADATION 14-1
15 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR MANAGEMENT OF IDENTIFIED ENVIRONMENTAL IMPACTS 15-1
15.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES 15-1
15.2 ACTIVITIES AND INFRASTRUCTURE 15-1
15.3 MANAGEMENT ACTIVITIES 15-1
15.4 ROLES AND RESPONSIBILITIES 15-2
16 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR SOCIO-ECONOMIC CONDITIONS 16-1
16.1 ASPECTS OF THE SOCIO-ECONOMIC CONDITIONS 16-1
16.2 OBJECTIVES AND GOALS 16-1
17 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR HISTORICAL AND CULTURAL ASPECTS 17-1
18 APPROPRIATE TECHNICAL AND MANAGEMENT OPTIONS CHOSEN FOR EACH IMPACT . 18-1
18.1 PROJECT ACTIONS, ACTIVITIES AND PROCESSES 18-1
18.2 TECHNICAL AND MANAGEMENT OPTIONS 18-1
19 ACTION PLANS TO ACHIEVE OBJECTIVES AND GOALS 19-1
20 EMERGENCY RESPONSE PROCEDURES 20-1
20.1 ON-GOING MONITORING AND MANAGEMENT MEASURES 20-1
20.2 PROCEDURES IN CASE OF ENVIRONMENTAL EMERGENCIES 20-1
20.2.1 GENERAL EMERGENCY PROCEDURE 20-1
20.2.2 IDENTIFICATION OF EMERGENCY SITUATIONS 20-2
20.3 TECHNICAL, MANAGEMENT AND FINANCIAL OPTIONS 20-2
21 PLANNED MONITORING AND EMP PERFORMANCE ASSESSMENT 21-1
21.1 PLANNED MONITORING OF ENVIRONMENTAL ASPECTS 21-1
21.1.1 WATER RESOURCES 21-1
21.1.2 AIR QUALITY 21-2
21.1.3 BIODIVERSITY MONITORING PROGRAMME 21-2
21.1.4 BLASTING 21-3
21.1.5 MINERALISED WASTE FACILITIES AND WATER DAMS 21-3

21.2 AUDITING AND PERFORMANCE ASSESSMENTS 21-4
21.3 FREQUENCY FOR REPORTING 21-4
22 FINANCIAL PROVISION 22-1
22.1 PLAN SHOWING LOCATION AND AERIAL EXTENT OF PROPOSED OPERATION 22-1
22.2 ANNUAL FORECASTED FINANCIAL PROVISION 22-1
22.3 CONFIRMATION OF AMOUNT TO BE PROVIDED 22-2
22.4 METHOD OF PROVIDING FINANCIAL PROVISION 22-2
23 ENVIRONMENTAL AWARENESS PLAN 23-1
23.1 ENVIRONMENTAL POLICY 23-1
23.2 STEPS TO ACHIEVE THE ENVIRONMENTAL POLICY OBJECTIVES 23-2
23.3 TRAINING OBJECTIVES OF THE ENVIRONMENTAL AWARENESS PLAN 23-3
23.3.1 GENERAL CONTENTS OF THE ENVIRONMENTAL AWARENESS PLAN 23-3
24 TECHNICAL SUPPORTING INFORMATION 24-1
25 CAPACITY TO MANAGE AND REHABILITATE THE ENVIRONMENT 25-1
25.1 AMOUNT REQUIRED TO MANAGE AND REHABILITATE THE ENVIRONMENT 25-1
25.2 AMOUNT PROVIDED FOR 25-1
26 UNDERTAKING SIGNED BY APPLICANT 26-1
27 ENVIRONMENTAL IMPACT STATEMENT & CONCLUSION 27-1
28 REFERENCES 28-1

LIST OF FIGURES

FIGURE 1: REGIONAL SETTING IV
FIGURE 2: LOCAL SETTING V
FIGURE 3: GEOLOGICAL SUCCESSION 1-61
FIGURE 4: GEOLOGICAL FEATURES 1-62
FIGURE 5: PERIOD AVERAGE WIND ROSES 1-63
FIGURE 6: SOIL FORMS WITHIN THE PROPOSED PROJECT AREAS 1-64
FIGURE 7: LAND CAPABILITY WITHIN THE PROPOSED PROJECT AREAS 1-65
FIGURE 8: VEGETATION TYPES 1-66
FIGURE 9: VEGETATION COMMUNITIES 1-67
FIGURE 10: HIGH BIODIVERSITY AREAS 1-68
FIGURE 11: HYDROLOGICAL CATCHMENTS 1-69
FIGURE 12: FLOODLINES 1-70
FIGURE 13: CONVERTED MINING RIGHTS AREA 1-71
FIGURE 14: SITE PHOTOGRAPHS TAKEN IN 8 MAJOR COMPASS DIRECTIONS (PIT8C) 1-72
FIGURE 15: SITE PHOTOS TAKEN IN 8 MAJOR COMPASS DIRECTIONS (SHAFT 16 WRD EXPANSION SITE) 1-73
FIGURE 16: INFRASTRUCTURE LAYOUT OF THE PROPOSED PIT8C PROJECT 2-14
FIGURE 17: INFRASTRUCTURE LAYOUT OF THE PROPOSED SHAFT 16 WRD EXPANSION PROJECT 2-15
FIGURE 18: GROUNDWATER MONITORING PROGRAMME 21-5
FIGURE 19: SURFACE WATER MONITORING PROGRAMME 21-6
FIGURE 20: AIR QUALITY MONITORING PROGRAMME 21-7
FIGURE 21: OVERALL INFRASTRUCTURE LAYOUT A 22-3
FIGURE 22: OVERALL INFRASTRUCTURE LAYOUT B 22-4
FIGURE 23: OVERALL INFRASTRUCTURE LAYOUT C 22-5
FIGURE 24: OVERALL INFRASTRUCTURE LAYOUT D 22-6
FIGURE 25: OVERALL INFRASTRUCTURE LAYOUT E 22-7
FIGURE 26: OVERALL INFRASTRUCTURE LAYOUT F 22-8

LIST OF TABLES

TABLE 1: SUMMARY OF POTENTIAL CUMULATIVE IMPACTS II

TABLE 2: PROJECT TIME FRAMES III
TABLE 3: REQUIREMENTS FOR EIA AND EMP REPORTS II
TABLE 4: EIA PROCESS VI
TABLE 5: PROJECT TEAM VII
TABLE 6: SUMMARY OF ABA RESULTS FOR WASTE ROCK MATERIAL 1-3
TABLE 7: RESULTS OF THE ANALYSIS ON THE LEACHATE ON WASTE ROCK (SLR, 2011) 1-5
TABLE 8: AVERAGE MONTHLY RAINFALL, MAXIMUM 1 DAY RAINFALL WITH CORRESPONDING DATE FOR THE RUSTENBURG-POL STATION 1-7
TABLE 9: AVERAGE RAINFALL INTENSITIES AND 24-HOUR STORM RAINFALL DEPTHS 1-8
TABLE 10: ERODIBILITY OF DIFFERENT SOIL TYPES 1-13
TABLE 11: MAMMALS IDENTIFIED WITHIN THE PIT8C AND SHAFT 16 WRD EXPANSION PROJECT AREAS 1-22
TABLE 12: MAMMAL DISTRIBUTION WITHIN THE PIT8C AND SHAFT 16 WRD EXPANSION PROJECT AREAS 1-22
TABLE 13: PROTECTED BIRD SPECIES IN TERMS OF THE NATURE CONSERVATION ORDINANCE 1-23
TABLE 14: REPTILES IDENTIFIED IN THE SURFACE USE AREA 1-23
TABLE 15: BUTTERFLY DIVERSITY WITHIN PLANT COMMUNITIES 1-24
TABLE 16: BUTTERFLY SPECIES THAT COULD POTENTIALLY OCCUR WITHIN THE PROPOSED PROJECT SITES 1-24
TABLE 17: RED DATA BUTTERFLY SPECIES POTENTIALLY OCCURRING WITHIN THE PROJECT AREAS 1-25
TABLE 18: CATCHMENT CHARACTERISTICS 1-28
TABLE 19: MONTHLY RAINFALL DISTRIBUTION FOR THE RUSTENBURG-POL STATION 1-28
TABLE 20: THE 24-HOUR STORM RAINFALL DEPTHS FOR VARIOUS RETURN PERIODS FOR THE RUSTENBURG-POL STATION 1-29
TABLE 21: MEAN ANNUAL RUNOFF 1-29
TABLE 22: CALCULATED FLOOD PEAKS 1-29
TABLE 23: SURFACE WATER QUALITY RESULTS 1-32
TABLE 24 SUMMARY OF GROUNDWATER QUALITY 1-37
TABLE 25: SUMMARY OF AMBIENT PM10 CONCENTRATIONS AS RECORDED FROM JANUARY 2009 TO JULY 2012 1-41
TABLE 26: SUMMARY OF DUSTFALL RESULTS (DEC 2009 – JUNE 2011) 1-43
TABLE 27: SUMMARY OF DUSTFALL RESULTS (JULY 2011 – JUNE 2012) 1-44
TABLE 28: UNEMPLOYMENT AND UNDER-EMPLOYMENT RATES OF SURROUNDING COMMUNITIES 1-53
TABLE 29: ELECTRIFICATION AND WATER PIPING OF SURROUNDING COMMUNITIES 1-54
TABLE 30: MINING RIGHTS IN THE PROPOSED PROJECT SITES 1-56
TABLE 31: LAND OWNERSHIP WITHIN THE PROPOSED PROJECT AREAS 1-56
TABLE 32: PROJECT DATA THAT PROVIDES PERSPECTIVE ON THE SCALE OF THE PROPOSED NEW PIT8C 2-1
TABLE 33: PROJECT DATA THAT PROVIDES PERSPECTIVE ON THE SCALE OF THE PROPOSED WRD EXPANSION. 2-1
TABLE 34: LIST OF PROJECT ACTIONS / ACTIVITIES / PROCESSES 2-5
TABLE 35: RELEVANT NEMA ACTIVITIES CURRENTLY BEING APPLIED FOR 2-16
TABLE 36: CONSTRUCTION PHASE TRAFFIC: MATERIALS AND STAFF 2-18
TABLE 37: OPERATIONAL PHASE TRAFFIC: MATERIALS AND STAFF 2-20
TABLE 38: DESIGN FEATURES FOR WASTE ROCK DUMP EXPANSION 2-21
TABLE 39: SAFETY CLASSIFICATION CRITERIA FOR WASTE ROCK DUMPS 2-23
TABLE 40: SPATIAL ANALYSIS FOR PIT8C 2-27
TABLE 41: LIST OF POTENTIAL IMPACTS AS THEY RELATE TO PROJECT ACTIONS / ACTIVITIES / PROCESSES (EXCLUDING SOCIAL AND CULTURAL) 3-1
TABLE 42: SOIL MANAGEMENT PRINCIPLES 7-13
TABLE 43: AIR POLLUTION EVALUATION CRITERIA 7-34
TABLE 44: PROXIMITY OF STRUCTURES TO THE PROPOSED OPENCAST EXPANSION PROJECT 7-40
TABLE 45: CRITERIA FOR ASSESSING IMPACTS 7-57
TABLE 46: CONSULTATION PROCESS WITH IAPS AND AUTHORITIES 10-2
TABLE 47: ENVIRONMENTAL OBJECTIVES AND GOALS – SOCIO-ECONOMIC CONDITIONS 16-1
TABLE 48: TECHNICAL AND MANAGEMENT OPTIONS 18-1
TABLE 49: ACTION PLAN – LOSS AND STERILISATION OF MINERAL RESOURCES 19-2
TABLE 50: ACTION PLAN – HAZARDOUS EXCAVATIONS AND INFRASTRUCTURE 19-2

TABLE 51: ACTION PLAN – LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH POLLUTION..19-5
TABLE 52: ACTION PLAN - LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE 19-6
TABLE 53: ACTION PLAN – PHYSICAL DESTRUCTION OF BIODIVERSITY 19-8
TABLE 54: ACTION PLAN – GENERAL DISTURBANCE OF BIODIVERSITY 19-9
TABLE 55: ACTION PLAN – POLLUTION OF WATER RESOURCES 19-11
TABLE 56: ACTION PLAN – ALTERATION OF NATURAL DRAINAGE PATTERNS 19-13
TABLE 57: ACTION PLAN – CONTAMINATION OF GROUNDWATER 19-14
TABLE 58: ACTION PLAN – DEWATERING..... 19-16
TABLE 59: ACTION PLAN –AIR POLLUTION..... 19-16
TABLE 60: ACTION PLAN – NOISE POLLUTION..... 19-19
TABLE 61: ACTION PLAN – BLASTING DAMAGE..... 19-20
TABLE 62: ACTION PLAN – TRAFFIC IMPACT 19-22
TABLE 63: ACTION PLAN – VISUAL IMPACTS 19-23
TABLE 64: ACTION PLAN – DESTRUCTION OF HERITAGE, PALEONTOLOGICAL AND CULTURAL RESOURCES 19-25
TABLE 65: ACTION PLAN – ECONOMIC IMPACT..... 19-25
TABLE 66: ACTION PLAN – INWARD MIGRATION 19-25
TABLE 67: ACTION PLAN – LAND USE IMPACTS 19-27
TABLE 68: EMERGENCY RESPONSE PROCEDURES..... 20-3
TABLE 69: MONITORING PARAMETERS FOR ANALYSIS AND REPORTING 21-1
TABLE 70: FINANCIAL PROVISION FOR THE PROPOSED PIT8C PROJECT (ETEK, SEPTEMBER 2012)..... 22-1
TABLE 71: FINANCIAL PROVISION FOR THE PROPOSED SHAFT 16 WRD PROJECT (ETEK, SEPTEMBER 2012)..... 22-1
TABLE 72: SUMMARY OF POTENTIAL CUMULATIVE IMPACTS..... 27-1

LIST OF APPENDICES

APPENDIX A: INFORMATION SHARING WITH AUTHORITIES ..... A
APPENDIX B: IAP DATABASE..... B
APPENDIX C: INFORMATION SHARING WITH IAPS..... C
APPENDIX D: COMMENTS AND RESPONSE REPORT ..... D
APPENDIX E: HERITAGE IMPACT ASSESSMENT ..... E
APPENDIX F: ECONOMIC LAND USE AND SUSTAINABILITY ANALYSIS ..... F
APPENDIX G: FINANCIAL PROVISION..... G
APPENDIX H: WRD EXPANSION DESIGN REPORT BY SLR..... H

ACRONYMS AND ABBREVIATIONS

Below a list of acronyms and abbreviations used in this report.

Acronyms / Abbreviations	Definition
ABA	Acid Base Accounting
AP	Acid Potential
Ar	Arcadia
BPDM	Bojanala Platinum District Municipality
BID	Background Information Document
CEC	Cation Exchange Capacity
CO_2	Carbon dioxide
DAFF	Department of Agriculture, Forestry and Fisheries
dBA	DeciBels Adjusted
DEDECT	Department of Economic Development, Environment, Conservation and Tourism
DMR	Department of Mineral Resources
DU	Domestic Use
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EAPSA	Environmental Assessment Practitioners of South Africa
EC	Electrical conductivity
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
ERD	Effective Rooting Depth
ESS	Earth Science Solutions
FGL	Final Ground Level
GGP	Gross Geographic Products
GN	Government Notice
HCs	Hydrocarbons
IAPs	Interested and Affected Parties
ICMM	International Council for Mining and Metals
IDW	Inverse Distance Weight
I.O.E	Index of erosion
IUCN	International Union for the Conservation of Nature
m	Meters
Mamsl	Metres above mean sea level
MAP	Mean annual precipitation
MAR	Mean annual runoff
Mbgl	Metres below ground level
MPRDA	Mineral and Petroleum Resources Development Act
MR	Mineral Right
NCO	Nature Conservation Ordinance

Acronyms / Abbreviations	**Definition**
NEMA	National Environmental Management Act
NLA	Newton Landscape Architects
NOx	Nitrogen oxides
NSS	Natural Scientific Solutions CC
NWEF	North West Eco Forum
NWA	National Water Act
NWU	North West University
NP	Neutralising Potential
MPRDA	Mineral and Petroleum Resources Development Act
PGM	Platinum Group Metals
PM	Particulate matter
RBA	Royal Bafokeng Administration
PES	Present Ecological State
PRECIS	PRECIS (National Herbarium Pretoria (PRE) Computerized Information System (CIS)
RLM	Rustenburg Local Municipality
ROM	Run of mine
RMF	Regional Maximum Flood
RSA	Republic of South Africa
SANBI	South African National Botanical Institute
SANS	South African National Standards
SAHRA	South African Heritage Resource Agency
SAR	Sodium Absorption Ratio
SAWS	South African Weather Services
Sw	Swartland
Ss	Sterkspruit
SLP	Social Labour Plan
SO_2	Sulphur dioxide
SVOCs	Semi-volatile Organic Compounds
TDS	Total Dissolved Solids
TSP	Total Suspended Particles
VOC	Volatile organic compounds
Wb	Witbank
WHO	World Health Organisation
WITS	University of Witwatersrand
WR	Water Resource
WRD	Waste rock dump

EXECUTIVE SUMMARY

Impala Platinum Limited (Impala) operates a mining and processing operation approximately 16 km from Rustenburg. In 2005, the Department of Mineral Resources (DMR) approved the Environmental Impact Assessment and Environmental Management Programme (EIA/EMP) amendment report for the mining of both the UG2 and Merensky reef using opencast mining and digging methods (Metago, 2005). A portion of the farm Vaalkop 275 JQ and Beerfontein 263 JQ was omitted from the related project area. Impala is proposing to undertake opencast activities referred to as the proposed Pit8C project, located on the farms Beerfontein 263 JQ and Vaalkop 275 JQ. The proposed Pit8C project will only target the Merensky reef.

In addition to this, Impala is proposing to expand the existing waste rock dump (WRD) at Shaft 16, located on the farm Reinkoyalskraal 278 JQ. The existing WRD at Shaft 16 was constructed in accordance with the relevant approved EIA/EMP amendment report for Shaft 16 (Golder 2004), however monitoring results have since indicated that the current WRD is contributing to a pollution plume. Impala is therefore proposing the Shaft 16 WRD expansion project, which is required in order to allow for improved pollution prevention measures on the expanded section of the dump.

The projects are located within Impala's surface use area at its Rustenburg operations. This area falls within the Rustenburg Local Municipality and Bojanala Platinum District Municipality in the North West Province. The regional and local settings are presented in Figure 1 and Figure 2 respectively.

SLR Consulting (Pty) Ltd (SLR), an independent firm of environmental consultants, has been appointed by Impala to manage the environmental authorisation processes.

In accordance with the requirements of the Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA), the EIA process comprises two phases: the scoping phase and the environmental impact assessment phase combined with the environmental management programme (EIA/EMP) phase. This report comprises the EIA and EMP for the proposed project.

Project motivation (need and desirability)

The addition of Pit8C as an opencast mining area is an economically viable option for Impala, and will optimise the extraction of mineral resources. The expansion of the Shaft 16 WRD is necessary as a pollution prevention measure. Given that existing workers will be used for the Pit8C project, the related benefit is job continuity. In the case of the WRD expansion, the strategy is to involve people from the local community as far as possible which has the potential to increase employment and procurement opportunities.

Environmental assessment process

Prior to the commencement of the proposed projects, environmental authorisation is required from key government departments. These include:

- an environmental decision from the DMR in terms of the MPRDA on the basis of an EIA/EMP amendment;
- an environmental decision in terms of the National Environmental Management Act, 107 of 1998 (NEMA) to authorise NEMA listed activities on the basis of a basic assessment process and the associated basic assessment report; and
- an amendment to the water use license from the Department of Water Affairs (DWA) in terms of the National Water Act (NWA) 36 of 1998 on the basis of a water use license application (WULA).

The related environmental assessment process, with regards to the requirements of the MPRDA, incorporated the following steps:

- The scoping process was conducted to identify relevant environmental, social and economic issues and to define the terms of reference for the required specialist studies and the EIA.
- Specialist studies were commissioned in accordance with the relevant terms of reference. The specialists were selected on the basis of their expertise and knowledge of the project area.
- The EIA report was compiled on the basis of the findings of the specialist studies and the project team.
- The EMP incorporates Impala's existing mitigation and management commitments in addition to those mitigation commitments that have been identified and described in the EIA.

Figure A – local setting

Stakeholder engagement

The stakeholder engagement process commenced prior to scoping and has continued throughout the environmental assessment process. As part of this process, authorities and interested and affected parties (IAPs) were given the opportunity to attend focused meetings, submit questions and comments to the project team, and review the letter of intent (which was provided as a background information document), scoping report and now the EIA/EMP reports. All comments that have been submitted to date by the authorities and IAPs have been included and addressed in the EIA/EMP report. Further comments arising from the EIA/EMP report review process will be handled in a similar manner.

Impact assessment findings per project component

The Shaft 16 WRD expansion and Pit8C projects are associated with different potential environmental, social and economic impacts when considered incrementally. The key impacts of each of the projects is summarised below.

Pit8C

The key factors that contribute to the potential impacts associated with the Pit8C project are its size, its nature , its location and its economic implications. The proposed Pit8C project will cover an area of approximately 5 hectares. Whilst the majority of this land has already been disturbed by existing Impala mining activities and infrastructure, there is a small portion of undisturbed veld which is used by ad-hoc grazers. Given that the proposed project is not located within the vicinity of any communities, limited impacts are anticipated and it is expected that the temporary change in land use which will result during the 12-18 month lifespan of the project will affect cattle grazers whom utilise the veld on an ad-hoc basis. Given the temporary nature of the proposed Pit8C project, it is expected that following successful rehabilitation the grazing potential of the area will be re-established.

The addition of Pit8C as an opencast mining area is an economically viable option for Impala, and will optimise the extraction of mineral resources. Given that existing workers will be used, the related benefits will be job continuity.

Shaft 16 WRD

The key factors that contribute to the potential impacts associated with the Shaft 16 WRD are its size, its nature, its duration, its location and its economic implications.

The proposed Shaft 16 WRD expansion will cover an area of approximately 19 hectares. Whilst the majority of this area has already been disturbed by agricultural activities (dryland sunflower cultivation), a small portion is comprised of vacant, undisturbed veld. Whilst Kanana is the closest community to the proposed site, it is envisaged that the effects of the change in land use will rather be felt by dryland sunflower farmer Mr Basi Ntsimane as well as ad-hoc cattle grazers. The RBA and Impala should engage with the relevant farmer with regards to compensation for lost ground. The proposed Shaft 16 WRD

expansion is expected to be in operation for approximately 30 years. In this regard, it will remain in perpetuity thereby permanently displacing the sunflower cultivation activities.

The expansion of the Shaft 16 WRD is necessary both as a pollution prevention measure and to cater for design imporovements which have been made subsequent to the existing WRD being developed (this was done in accordance with Impala's approved EMP). The strategy is to involve people from the local community as far as possible which has the potential to increase employment and procurement opportunities. It is estimated that approximately 10-20 new job opportunities will be created (these will be for the construction phase only)

Cumulative impact assessment summary

A tabulated summary of the cumulative impacts of the current Impala operations and both of the abovementioned project components is provided in Table 1.

TABLE 1: SUMMARY OF POTENTIAL CUMULATIVE IMPACTS

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)	
		Unmitigated	Mitigated
Geology	Loss and sterilisation of mineral resources	**M**	**L**
Topography	Hazardous excavations and infrastructure	**H**	**M**
Soils and land capability	Loss of soil resources and land capability through pollution	**H**	**L**
	Loss of soil resources and land capability through physical disturbance	**H**	**L (M for WRD**
Biodiversity	Physical destruction of biodiversity	**H (M for WRD)**	**M-L**
	General disturbance of biodiversity	**M**	**M-L**
Surface water	Pollution of water resources	**H**	**L**
	Alteration of natural drainage lines	**H**	**M**
Groundwater	Contamination of groundwater	**H**	**L**
	Dewatering	**M**	**L**
Air quality	Air pollution	**H**	**M**
Noise	Noise pollution	**L**	**L**
Blasting	Blasting impacts	**H**	**M**
Traffic	Road disturbance and traffic safety	**H**	**M**
Visual	Visual impacts	**M**	**L**
Heritage, palaeontological and cultural resources	Loss of heritage, palaeontological and cultural resources	**N/A**	**N/A**
Socio-economic	Economic impact	**M+**	**H+**
	Inward migration	**H**	**H-M**
Land use	Land use impact	**H**	**L**

Project timing

The projects will only proceed if they are approved. Table 2 sets out the related time frames.

TABLE 2: PROJECT TIME FRAMES

Aspect	Timeframe
Pit8C	
Start construction	Construction will commence in 2013 subject to authorisation
Duration of construction phase	Approximately 3- 5 months (opening of boxcut)
Life of operation	Approximately 12-18 months
Shaft 16 WRD expansion	
Start construction	Construction will commence in 2013 subject to authorisation
Life of operation	Approximately 30 years

Conclusion

The EIA/EMP amendment report presents the projects plan as defined by Impala, presents findings of specialist studies, identifies and assesses potential impacts on the receiving environment in both the unmitigated and mitigated scenarios, including cumulative impacts, and identifies measures together with monitoring programmes to monitor and mitigate potential impacts.

The assessment of the proposed projects presents the potential for negative impacts to occur (in the unmitigated scenario in particular) on the bio-physical, cultural and socio-economic environments both on the project sites and in the surrounding area. With mitigation these potential impacts can be prevented or reduced to acceptable levels.

The economic impact assessment concluded that the development of the project will have positive economic impacts. Moreover, the integrated alternative land use assessment concluded that the proposed project components are the preferred land use alternative.

It follows that provided the EMP is effectively implemented there is no environmental, social or economic reason why the project should not proceed.

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED SHAFT 16 WASTE ROCK DUMP EXPANSION AND OPENCAST ACTIVITIES AT PIT8C

INTRODUCTION

Introduction to the proposed projects

Impala Platinum Limited (Impala) operates a mining and processing operation approximately 16 km from Rustenburg. In 2005, the Department of Mineral Resources (DMR) approved the Environmental Impact Assessment and Environmental Management Programme (EIA/EMP) amendment report for the mining of both the UG2 and Merensky reef using opencast mining and digging methods (Metago, 2005). A portion of the farm Vaalkop 275 JQ and Beerfontein 263 JQ was omitted from the original project area. Impala is proposing to undertake opencast activities referred to as the proposed Pit8C project, located on the farms Beerfontein 263 JQ and Vaalkop 275 JQ. The proposed Pit8C project will only target the Merensky reef.

In addition to this, Impala is proposing to expand the existing waste rock dump (WRD) at Shaft 16, located on the farm Reinkoyalskraal 278 JQ. The existing WRD at Shaft 16 was constructed in accordance with the relevant approved EIA/EMP amendment report for Shaft 16 (Golder 2004), however monitoring results have since indicated that the current WRD is contributing to a pollution plume. Impala is therefore proposing the Shaft 16 WRD expansion project, which is required in order to allow for improved pollution prevention measures on the expanded section of the dump.

The projects are located within Impala's surface use area at its Rustenburg operations. This area falls within the Rustenburg Local Municipality and Bojanala Platinum District Municipality in the North West Province. The regional and local settings are presented in Figure 1 and Figure 2 respectively.

SLR Consulting (Pty) Ltd (SLR), an independent firm of environmental consultants, has been appointed by Impala to manage the environmental authorisation processes.

In accordance with the requirements of the Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA), the EIA process comprises two phases: the scoping phase and the environmental impact assessment phase combined with the environmental management programme (EIA/EMP) phase. This report comprises the EIA and EMP for the proposed project.

Project motivation (need and desirability)

The addition of Pit8C as an opencast mining area is an economically viable option for Impala, and will optimise the extraction of mineral resources. The expansion of the Shaft 16 WRD is necessary as a pollution prevention measure. Given that existing workers will be used for the Pit8C project, the related benefit is job continuity. In the case of the WRD expansion, the strategy is to involve people from the local community as far as possible which has the potential to increase employment and procurement opportunities.

Legal framework/environmental approvals and permits

Prior to the commencement of the proposed projects, environmental authorisation is required from government departments. These include:

- an environmental decision from the DMR in terms of the MPRDA on the basis of an EIA/EMP amendment;
- an environmental decision in terms of the National Environmental Management Act, 107 of 1998 (NEMA) to authorise NEMA listed activities on the basis of a basic assessment process and the associated basic assessment report; and
- an amendment to the water use license from the Department of Water Affairs (DWA) in terms of the National Water Act (NWA) 36 of 1998 on the basis of a water use license application (WULA).

This report is the environmental impact assessment (EIA) (Section 1) and environmental management programme (EMP) (Section 2) for the project. Given the legal framework above, this report has been compiled to meet the requirements of the MPRDA Regulations. In this regard, the new DMR report structure template has been used. To assist with cross-referencing in the report, the chapter numbering in the EMP section follows on from the chapter numbering in the EIA section.

In terms of Regulation 704 (4 June 1999) and Section 73 of Regulation 527, Table 3 provides a guide to the relevant sections within which the relevant information is contained.

TABLE 3: REQUIREMENTS FOR EIA AND EMP REPORTS

Mining Regulation 527	Section in report
Regulation 50 - Environmental Impact Assessment	
Assessment of the environment likely to be affected by the proposed mining operation, including cumulative environmental impacts	Sections 1, 2 and 3
Assessment of the environment likely to be affected by the identified alternative land use or developments, including cumulative environmental impacts	Sections 4 and 5
Assessment of the nature, extent, duration, probability and significance of the identified potential environmental, social and cultural impacts of the proposed mining operation, including the cumulative environmental impacts	Section 6 and 7
Comparative assessment of land use and development alternatives regarding environment, social and cultural impacts	Section 8
Determine appropriate mitigatory measures for each significant impact. Describe arrangements for monitoring and management of impacts	Section 9
Details of the public engagement process and identification of how all issues raised have been addressed	Section 10
Knowledge gaps, adequacy of predictive measures, assumptions and uncertainties	Section 11
Description of the arrangement for monitoring and management of environmental impacts	Section 12
Include appendices for supporting and technical information	Section 13
Regulation 51 - Environmental management programme	
Description of objectives and specific goals for mine closure, and management of environmental impacts, socio-economic conditions, historical and cultural aspects	Section 14, 15,16 and 17
Description of the appropriate technical and management options chosen for each environmental impact, socio-economic condition and historical and cultural aspect for each phase of the mining operation	Section 18

Mining Regulation 527	**Section in report**
Action to achiever the objective and specified goals which included time schedule	Section 19
Procedures for environmental related emergencies and remediation	Section 20
Planned monitoring and EMP performance assessment	Section 21
Financial provision for remediation and closure – quantum and method of provision	Section 22
Environmental awareness plan	Section 23
Appendices for supporting information	Section 24
Signed undertaking to comply with the provisions of the Act and Regulations	Section 25

FIGURE 1: REGIONAL SETTING

FIGURE 2: LOCAL SETTING

EIA approach and process

A summary of the approach and key steps in the combined EIA process and corresponding activities are outlined in Table 4.

TABLE 4: EIA PROCESS

Objectives	Corresponding activities
Project initiation and application phase (November 2011 - August 2012)	
• Notify the decision making authorities of the proposed project. • Initiate the environmental impact assessment process.	• DWA attended a site visit and WULA meeting at Impala on 11 November 2011. • NEMA application for the Basic Assessment report was submitted to DEDECT on 25 July 2012 in terms of the 2006 EIA regulations. Reference number received on 13 August 2012. • DMR was notified in writing of the proposed project on 3 August 2012 • WULA submitted to DWA on 2 July 2012 (accepted on 18 July 2012)
Scoping phase (August 2012 - September 2012)	
• Identify interested and/or affected parties (IAPs) and involve them in the scoping process through information sharing. • Determine the issues associated with the proposed project. • Consider alternatives. • Identify any fatal flaws. • Identify specialist investigations • Determine the terms of reference for additional assessment work.	• Notify IAPs of the projects and environmental assessment process (focused meetings, distribution of letter of intent, newspaper advertisements, telephone calls and site notices) in August 2012. • Focused scoping meetings (August 2012). • Record keeping of all comments received (September 2012 to January 2013). • Compile scoping report including a description of environmental issues and terms of reference for further investigations. • Distribute scoping report to DMR, IAPs and other regulatory authorities for review (September 2011). • Record comments (October 2012).
EIA/EMP phase (August 2012-February 2013)	
Detailed specialist investigations (August 2012-October 2012)	
• Describe the affected environment. • Assess potential impacts. • Provide management and monitoring recommendations.	• Investigation by technical project team and appointed specialists.
EIA/EMP phase (August 2012-February 2013)	
• Assess potential impacts with assistance from appointed specialists where required. • Design requirements and management and mitigation measures. • Receive feedback on application.	• Compile and distribute EIA/EMP and Basic Assessment report to authorities and IAPs for review (October 2012). • Focused feedback meetings with IAPs (November 2012). • Record comments (November 2012). • Forward IAP comments to DMR (November 2012). • Circulate record of decisions.

EIA team

The project team is outlined in Table 5. Caitlin Pringle, Natasha Daly and Brandon Stobart are the responsible SLR environmental assessment practitioners (EAPs) for managing the project and compiling the final report. Neither Caitlin Pringle, Natasha Daly nor Brandon Stobart nor SLR have any interest in

the project other than fair payment for consulting services rendered as part of the environmental assessment process.

TABLE 5: PROJECT TEAM

Name	Designation	Tasks and roles	Company
Environmental impact assessment and public involvement team			
Natasha Daly	Project managers	Process management, stakeholder engagement, assessment and report compilation.	SLR
Caitlin Pringle			
Brandon Stobart	Project revirew	Report review	
Specialist environmental assessment consultant team			
Dr Julius Pistorius	Heritage specialist	Heritage assessment	Independent consultant
Gerrie Muller	Socio-economic specialist	Economic landuse and sustainability analysis	Strategy4Good
Leon Koekemoer	Closure engineer	Closure costing	E-TEK Consulting

Contact details for applicant

The contact details for the project team/mine are included below.

Project applicant:	Impala Platinum Limited
Contact person:	Mr Jako Pienaar
Postal address:	PO Box 5683 Rustenburg 0300
Telephone No:	+ 27 14 569 8518
E-mail address:	jako.pienaar@implats.co.za

Regional Setting

The regional and local setting of the mine and project is outlined below and illustrated in Figure 1 and Figure 2 respectively.

Aspect	Detail
Province	North West
Magisterial district	Rustenburg
Local authority	Rustenburg Local Municipality and Bojanala Platinum District Municipality
Municipal wards	Wards 4, 23, 24 and 38
Farms on which project will take place	The proposed projects are located on the farms Beerfontein 263 JQ, Vaalkop 275 JQ and Reinkoyalskraal 278 JQ located within Impala's surface use area. Refer to Section 1.3.4 for land ownership details.
Nearest towns	The closest regional town is Rustenburg, located approximately 15 km south of the Impala surface use area. Descriptions of the closest local communities are provided in Section 1.3.4.
Presence of servitudes	Powerlines, pipelines and roads are located within the footprint areas of both the proposed Shaft 16 WRD expansion project and Pit8C project sites (Section 1.3.4).
Use of immediately adjacent land	Immediate and adjacent land associated with the proposed Shaft 16 WRD and Pit8C project is utilised for agricultural purposes such as dryland sunflower

Aspect	Detail
	cultivation and ad-hoc grazing respectively.
Water catchment and management area	The proposed projects are drained by the Elands River Catchment and the Hex River Catchment, within quaternary catchments A22F and A22H both of which fall within the Limpopo A drainage region.
Topographic landmarks	Sun City (±20 km North West) and Pilanesburg National Park (±18 km North West)
Co-ordinates of project area	Pit8C site: S 25.322765°; E 27.114832° Shaft 16 WRD expansion site: S 25.333439°; E 27.165794°

SECTION 1 – ENVIRONMENTAL IMPACT ASSESSMENT

1 DESCRIPTION OF THE BASELINE ENVIRONMENT

1.1 ON-SITE ENVIRONMENT RELATIVE TO SURROUNDING AREA

1.1.1 GEOLOGY BASELINE

This section has been compiled using the open pit 2005 EIA/EMP amendment report (Metago, January 2005), the EIA/EMP amendment report for Shaft 16 (GCS, 2004), the environmental risk assessment for chrome and waste rock (Metago, September 2009), as well as specialist studies completed for various subsequent reports completed by SLR for Impala. In addition to this, information from the recent site visits by SLR personnel was used.

Introduction and link to impacts

As a baseline, the geology and associated structural features provides a basis from which to understand:

- the potential for sterilisation of mineral reserves;
- the geochemistry and related potential for the pollution of water from mineralised waste stockpiles; and
- the geophysics and related potential for geological lineaments such as faults and dykes. Faults, dykes and other lineaments can act as preferential flow paths of groundwater which can influence both the dispersion of potential pollution plumes and the inflow of water into mine workings.

Geological processes also influence soils forms (see Section 1.1.4) and the potential for palaeontological resources (see Section 1.3.1).

To understand the basis of these potential impacts, a baseline situational analysis is described below.

Data collection

Regional geological data collection was done through review of available studies and topographical maps.

Existing topgraphical maps were reviewed to identify potential geological lineaments.

Existing geochemical sampling and leachate analysis results from samples taken from existing waste rock stockpiles at Impala were reviewed, and in addition to this, Acid Base Accounting (ABA) was done to determine the potential for acid generation.

Results

Regional geology

Impala is situated in the Bushveld Igneous Complex (BIC). The BIC is an intrusive igneous body, extending about 400 km from east to west and about 350 km from north to south. The BIC consists of

crystalline material such as norites and pyroxenites. The BIC comprises an unweathered and intact rock matrix with negligible matrix porosity and permeability, and planes of discontinuity in the rock matrix, including both faults and joint plant (collectively referred to as fractures).

Local Geology

Impala is located in the Western Limb of the BIC, where the layers dip at approximately 10 - 20° into the basin. The ultramafic-mafic rocks of the BIC are known as the Rustenburg Layered Suite. The rocks of the Rustenburg Layered Suite range from ultrabasic pyroxenties and anorthosites in the lower parts to norite, gabbro and magnetite gabbro in the upper parts. The Rustenburg Layered Suite is subdivided into the Marginal, Lower, Critical and Upper Zones. The proposed Pit8C project is located on the Mathlagame Norite-anthosite of the Critical zone. The proposed Shaft 16 WRD is located on the Pyramid Gabbro Norite of the Main Zone.

Operations geology

The UG2 and Merensky reefs are both currently being mined at Impala. The proposed Pit8C project will however only target the Merensky reef which outcrops just below surface in the proposed project area. The Merensky chromitite layer has an average thickness of approximately 1 m and dips at an angle of between 9 and 12° in a north-easterly direction. The Merensky reef horizon comprises of a basal pyroxenitic portion, which includes a pyroxenite, a pegmatiodal pyroxenite and chromitite layers that may be present and a portion of the anorthositic norite below the chromitite layers. Overlying the pyroxenite layers is a norite grading into a spotted anorthosite and mottled anorthosite. The Pit8C site is overlain by a black turf (Section 1.1.4) layer of up to 2 m thick. Underlying this is the Mathlagame Norite-anorthosite formation of the Upper Critical Zone. The main rock types in the Upper Critical Zone are orthopyroxinite, norite (plagioclase/pyroxene), chromatite, anorthosite (plagioclase) and harzburgite (olivine). This unit contains the Merensky Reef and UG2 Chrome Seams.

Merensky reef

The Merensky Reef is a coarse grained layer. It has a small percentage of sulphides. The Merensky Reef Horizon comprises of a basal pyroxenitic portion, which includes a pyroxenite, a pegmatiodal pyroxenite and chromitite layers that may be present and a portion of the anorthositic norite below the chromitite layers (Figure 3). Overlying the pyroxenite layers is a norite grading into a spotted anorthosite and mottled anorthosite. The informal reference on Impala refers to the layer below the chromitite as Footwall 1 and above the reef is referred as Middling 1 to Middling 3. The Merensky Reef can be classified into different types within the proposed project areas. Whenever the basal chromitite layers are lying on the footwall 1 unit, it is referred to as Merensky A Reef. If the reef horizon potholes to igneous layers below footwall 1, it is classified as Merensky B reef (Footwall 2, cyclic unit consisting of anorthosite and pyroxenite) or Merensky C reef (Footwall 3, anorthositic norite).

Lineaments

Geographical features identified within and surrounding the proposed project sites are described below. Refer to Figure 4 for the position of dykes and faults within the proposed project areas.

Dykes

Dykes are dolerite intrusions that vary in thickness and can extend up to 40 m thick in places. The local geology is also characterised by dykes that range in thickness from 0.2 to 2.0 m.

With reference to Figure 4, no dykes have been identified beneath the project footprints of either project site. Ther are however some dykes further afield from the WRD expansion.

Faults

The underground workings have encountered numerous faults and to date the maximum displacement has been 10 m. There are larger as well as reverse faults in the local geology; although uncommon.

No faults were identified within close proximity or within the footprint areas of the proposed Pit8C and Shaft 16 WRD sites.

Geochemical analysis – Waste Rock (Shaft 16 WRD expansion project)

Four samples were used to determine the acid rock drainage potential of waste rock material. The ABA results of the four samples are outlined in Table 6 (Wade and Glass, July 2008).

TABLE 6: SUMMARY OF ABA RESULTS FOR WASTE ROCK MATERIAL

Components	**Sample 1**	**Sample 2**	**Sample 3**	**Sample 4**
Paste pH	10.44	9.2	6.6	9.12
Total sulphur (%)	0.11	0.02	0.00	0.03
Acid potential (AP) (kg/t)	3.5	0.7	0.2	0.9
Neutralisation Potential (NP)	187.5	96.7	17.4	101.3
Net Neutralisation Potential (NNP = NP + NA)	184.0	96.1	17.3	100.4
Neutralising Potential Ration	54.05	147.40	111.44	115.71

From an acid generating perspective the waste rock material is considered to have sufficient neutralising potential and is therefore regarded as non-acid generating.

Two samples were used to determine the leachate potential of waste rock within the Impala surface use area. The results of the waste rock leachate laboratory tests (at a neutral pH) are presented in Table 7.

TABLE 7: RESULTS OF THE ANALYSIS ON THE LEACHATE ON WASTE ROCK (SLR, 2011)

All in [mg/L]	Alkalinity as CaCO3	EC (mS/m)	pH	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Cl
WHO Drinking Water (2008)	N/A		N/A	N/A	0.2	0.01	0.5	0.7	N/A	N/A	300	0.003	250
IFC Mining Effluents (2007)	N/A		N/A	N/A	N/A	0.1	N/A	N/A	N/A	N/A	N/A	0.05	N/A
SANS Class I		<150	5.0-9.5		<0.3	<0.01					<150	<0.005	<200
SANS Class II		150 - 370	4.0-10		0.3 - 0.5	0.01 - 0.05					150-300	0.005 - 0.01	200-600
SANS Class II (Period of Consumption)		7 years			1 year	1 year					7 years	6 months	7 years
Livestock watering	N/A	N/A	N/A	N/A	0 - 5	0 - 1	0 – 5	N/A	N/A	N/A	0 - 1000	0 -10	0 - 3000
Sample 1	20	58.5	7.90	<0.01	<0.01	<0.01	<0.01	0.06	<0.01	<0.01	74	<0.01	73
Sample 2	8	22.5	7.90	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	22	<0.01	32

Red- Exceedance of all human health guideline limits

All in [mg/L]	Co	Cr	Cu	F	Fe	K	Li	Mg	Mn	Mo	Na	Ni	Cr^{+6}
WHO Drinking Water (2008)	N/A	0.05	2	1.5	N/A	N/A	N/A	N/A	0.400	0.07	200	0.07	0.05
IFC Mining Effluents (2007)	N/A	N/A	0.3	N/A	2	N/A	N/A	N/A	N/A	N/A	N/A	0.5	0.1
SANS Class I	<0.5	<0.1	<1	<1.0	<0.2	<50		<70	<0.1		<200	<0.15	
SANS Class II	0.5-1	0.1 - 0.5	1-2	1.0-1.5	0.2-2	50 - 100		70-100	0.1-1		200 - 400	0.15- 0.35	
SANS Class II (Period of Consumption)	1 year	3 months	1 year	1 year	7 years	7 years		7 years	7 years		7 years	1 year	
Livestock watering	0 -1	0 -1	0 - 1	0 - 2	0 -10	N/A	N/A	0 - 500	0 - 10	0 – 0.01	0 - 2000	0 - 1	0 -1
Sample 1	<0.01	<0.01	<0.01	<0.2	0.354	5.0	<0.01	1.58	<0.01	<0.01	26	<0.01	<0.01
Sample 2	<0.01	0.062	<0.01	<0.2	0.780	2.0	<0.01	0.395	0.011	<0.01	9.9	<0.01	<0.01

Red- Exceedance of all human health guideline limits

All in [mg/L]	NO3_N	P	Pb	SO_4	Sb	Se	Si	Sn	Sr	Ti	V	Zn
WHO Drinking Water (2008)	11.3	N/A	0.01		0.02	0.01	N/A	N/A	N/A	N/A	N/A	N/A
IFC Mining Effluents (2007)	N/A	N/A	0.2		N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5
SANS Class I	<10		<0.02	<400	<0.01	<0.02					<0.2	<5
SANS Class II	10 - 20		0.02 - 0.05	400-600	0.01-0.05	0.02- 0.05					0.2- 0.5	5 - 10
SANS Class II (Period of Consumption)	7 years		3 months	7 years	1 year	1 year					1 year	1 year
Livestock watering	0 - 100	N/A	0 – 0.1	0 - 1000	N/A	N/A	0 - 50	N/A	N/A	N/A	0 – 1	0 -20
Sample 1	24	0.763	<0.01	46	<0.01	<0.01	<0.01	<0.01	0.315	<0.01	<0.01	<0.01
Sample 2	9	0.778	<0.01	9	<0.01	<0.01	<0.01	<0.01	0.068	<0.01	<0.01	<0.01

(SLR, December 2011)

*SANS Class 1: Good quality water suitable for lifetime consumption.

**SANS Class II: Marginal water quality with a maximum allowance for consumption. The period of consumption is indicated in years in the above table.

Leachate tests indicate that the waste rock is alkaline in nature and shows potential for elevated iron and nitrate concentrations.

Conclusion

Where new permanent infrastructure is placed within close proximity to mineable ore there is the possibility that sterilisation can occur. In the case of both projects, it is not envisaged that the location of permanent infrastrucuture will result in any sterilisation of minerals.

Geochemical tests and analysis indicate that waste rock from both projects should be non-acid generating. There is however the potential for seepage concentrations to exceed the drinking water guideline limits for various parameters. This presents a potential pollution risk for both surface and groundwater in the both the short and long term. It follows that short and long term pollution prevention and/or treatment measures must be considered.

No dykes have been identified beneath the project footprints of either project site. Ther are however some dykes further afield from the WRD expansion site. These lineaments are not considered to be preferential flow paths for contamination and therefore do not affect the site selection or design of the expanded section of the WRD.

1.1.2 CLIMATE BASELINE

Information in this section was sourced from the Air Quality Impact Assessment for the proposed Impala Tailings Dam and Open Pits Expansion Project (Airshed, March 2012), and the Surface Water Assessment for Floodline Modelling done for the Impala surface use area (Metago, September 2011).

Introduction and link to impact

As a whole, the various aspects of the climate that are discussed influence the potential for environmental impacts and related mine/infrastructure design. Specific issues are listed below:

- Rainfall could influence erosion, evaporation, vegetation growth, rehabilitation planning, dust suppression, and surface water management planning.
- Temperature could influence air dispersion through impacts on atmospheric stability and mixing layers, vegetation growth, and evaporation which could influence rehabilitation planning; and
- Wind could influence erosion, the dispersion of potential atmospheric pollutants, and rehabilitation planning.

To understand the basis of these potential impacts, a baseline situational analysis is described below.

Data collection

Average meteorological data was used to facilitate a comprehensive understanding of the ventilation potential of the Impala mine and to provide input requirements for dispersion simulations. A

comprehensive data set for at least one year of detailed hourly average wind speed, wind direction and temperature data was needed for the dispersion simulations. Meteorological data was sourced from the stations located at Boshoek, Services, Lebone, Luka and Shaft 7b.

Rainfall and evaporation data for the site was considered from various sources including weather stations managed by both the South African Weather Services (SAWS) and DWA. These include the Rustenburg-POL station (0511400 W).

Results

Regional climate

The proposed project sites fall within the Highveld Climatic Zone. Of the mean annual precipitation, 85% falls during summer thunderstorms. The thunderstorms generally occur every 3 to 4 days in summer and are of short duration and high intensity. Temperatures in this climatic zone are generally mild, but low minima can be experienced in winter due to clear night skies. Frost characteristically occurs in the winter months. Generally winds are light, but south-westerly winds associated with thunderstorms are typically strong and gusty (Metago, May 2011).

Rainfall

The annual average rainfall for the Rustenburg region is approximately 665 mm, mainly occurring as a result of thunderstorms between October and March, peaking in January. Hail can be expected, on an average 4 times a year (Metago, May 2011).

The average monthly rainfall that may be experienced within the project areas are included in Table 8.

TABLE 8: AVERAGE MONTHLY RAINFALL, MAXIMUM 1 DAY RAINFALL WITH CORRESPONDING DATE FOR THE RUSTENBURG-POL STATION

Month	Ave Rainfall Depth (mm)	Max 1 day Depth (mm)	Corresponding Rain Date
JAN	118.1	94	19/01/1972
FEB	96.1	98	28/02/1981
MAR	89.1	140	19/03/1976
APR	48.5	100.5	10/04/1961
MAY	15.5	62.2	06/05/1956
JUN	8.6	70	10/06/1957
JUL	4.9	46	02/07/1957
AUG	7.6	30	31/08/1943
SEP	18	65	27/09/1987
OCT	50.2	88.1	18/10/1944
NOV	87.4	66	18/11/1934
DEC	114.3	119.4	27/12/1909

(Metago, September 2011)

Rainfall data sourced from the Rustenburg-POL weather station has a reliable daily record length of 87 years, with an average MAP of 665 mm. From the South African Weather Bureau data, the highest intensity rainfall per month recorded for the Rustenburg-POL weather station was 384 mm in January 1909. The 24-hour storm rainfall depths for various return periods are included in Table 9.

TABLE 9: AVERAGE RAINFALL INTENSITIES AND 24-HOUR STORM RAINFALL DEPTHS

Return period / recurrence interval (year)	24-hour rainfall depth (mm)
2	60
5	81
10	97
20	113
50	135
100	152
200	171

(Metago, September, 2011)

Temperature

The average minimum temperatures recorded are -2.6 °C in the winter months during June with a maximum average temperature of 36.7 °C in the summer months between February and November. Temperatures reached a minimum just before sunrise at around 06:00 and a maximum at around 16:00 (Airshed, March 2012).

Wind

Wind roses comprise 16 spokes which represent the directions from which winds blew during the period (Airshed, March 2012). The colours reflected the different categories of wind speeds, the orange area, for example, representing winds of 3 m/s to 6 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. The frequency, at which calms occurred, i.e. periods during which the wind speed was below 1 m/s, is also indicated.

Diurnal and seasonal wind roses generated from data recorded within the project areas between January 2009 and December 2010 are presented in Figure 5.

In general, the wind field is dominated by winds from the east, south and south-western sector. During the day, winds occur most frequently from the east and west-northwest with calm periods occurring 32% of the time. During the night, the wind shifts, blowing from the south, south-east and south-west with calm periods occurring 41% of the time. The most distinct shift in the seasonal wind field is observed during spring when southerly winds occurred most frequently. Wind speeds above 5.4 m/s can carry dust particles. 36% of the winds recorded during 2009 and 2010 were below 1 m/s.

Evaporation

Evaporation figures recorded for the area are high. The average annual evaporation is approximately 2 000 mm. The highest evaporation occurs in January (more than 200 mm) and the lowest evaporation in June (less than 100 mm) (Metago, September 2010).

Conclusion

The proposed project sites are characterised by rainy seasons with heavy thunderstorms that last for short periods at a time. High evaporation rates reduce infiltration rates, while the high rainfall events can increase the erosion potential and the formation of erosion gullies. The presence of vegetation does however allow for surface infiltration thereby reducing the effects of erosion. The mixing of layers resulting in the formation of temperature inversions, and the presence of cloud cover limits the dispersion of pollutants into the atmosphere. In general wind speeds are below 5.4 m/s and not able to carry all types of dust particles, however this is dependent on the material type. These climatic aspects need to be taken into consideration during rehabilitation and surface water management planning.

1.1.3 TOPOGRAPHY BASELINE

Information for the topography section was sourced from site visits by the EIA project team.

Introduction and link to impacts

Changes to the current topography through the development of the Shaft 16 WRD expansion and Pit8C projects may impact on surface water drainage (Section 1.1.7), visual aspects (Section 1.1.11) and the safety of both people and animals. To understand the basis of these potential impacts, a baseline situational analysis is described below.

Data Collection

The main source of data collection was a series of site visits by the EIA project team, review of topographical maps and a review of the project layout in relation thereto.

Results

The proposed projects are situated in an area of gently undulating plains with slopes primarily ranging between 1% and 10% at an average altitude of 1130 metres above mean sea level (mamsl).

Given that the proposed site for Pit8C is located within Impala's existing mining operations and infrastructure, the topography of the site is relatively disturbed. The Shaft 16 WRD expansion site is located in part on undisturbed veld but it must be noted that the majority of this area has been transformed for dryland synflower cultivation purposes, therefore the topography has already been altered.

Conclusion

Mining activities and infrastructure have the potential to alter the topography and the natural state of areas. An alteration of the natural topography has the potential to change surface water flow patterns and present dangers to both animals and people.

1.1.4 SOIL BASELINE

Information in this section was sourced from the Soil Study conducted by Earth Science Solutions (ESS, February 2010).

Introduction and link to impacts

Soils are a significant component of most ecosystems. As an ecological driver, soil is the medium in which most vegetation grows and a range of vertebrates and invertebrates exist. In the context of mining operations, soil is even more significant if one considers that mining is a temporary land use whereafter rehabilitation (using soil) is the key to re-establishing post closure land capability that will support post closure land uses.

Mining projects have the potential to damage the soil resource through physical loss of soil and/or the contamination of soils, thereby impacting on the soils ability to sustain natural vegetation and altering land capability. Contamination of soils may in turn contribute to the contamination of surface and groundwater resources. Loss of the topsoil resource reduces chances of successful rehabilitation and restoration. To understand the basis of these potential impacts, a baseline situational analysis is described below.

Data Collection

Data was obtained through the review of existing geological information, previous studies conducted for the Impala mining operations and land type mapping.

A field survey was undertaken during which the different soils were mapped and classified. In addition to this soil samples were taken in order to investigate/log and classify the different soil profiles. The procedure adopted in field when classifying the soil profiles is as follows:

- Demarcate master horizons;
- 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); and
  - compaction (from surface)

- Determine from i) and ii) the appropriate Soil Form; and
- Establishing provisionally the most likely Soil Family.

Terrain information, topography and any other infield data of significance were also recorded, with the objective of identifying and classifying the area in terms of:

- the soil types disturbed or that might be disturbed/rehabilitated;
- the soil physical and chemical properties;
- the soil effective rooting depths (ERD);
- the erodibility of the soils;
- the soil utilisation potential; and
- the soil nutrient status.

The identification and classification of soil profiles were carried out using the Taxonomic Soil Classification System.

Results

Soil forms

Soil forms located within the proposed project areas include Arcadia, Kroonstad, Rensburg, Sterkspruit, Swartland and Witbank (Figure 6).

Pit8C project area

Witbank (Wb)- Man induced

The Witbank soil form represents disturbed areas associated with existing infrastructure.

Shaft 16 WRD expansion project area

Arcadia (Ar)

The Arcadia soil forms identified within the project areas comprise the following characteristics:

- highly structured soils and exhibits extremely strong vertical columns of structure from the surface;
- Generally grey but can be black;
- Clay content is between 40 and 65%;
- In their in situ status they are generally poorly leached soils, however they are of an alluvial origin (river derived soils) and therefore have the potential to be highly leached; and
- ERD of approximately 200 mm – 400 mm.

Kroonstad (Kd)

The Kroonstad soil Forms are associated with wetland and vlei areas comprise the following characteristics:

- moderate to highly structured;

- pale yellow, brown to dark brown and red;
- moderate clay content (between 25 – 35%);
- pale yellow brown soils are highly leached while dark brown to red are poorly leached soils; and
- ERD of between 400 mm and 600 mm.

Rensburg (Rg)

The Rensburg soils located within the project areas comprise the following characteristics:

- The glaycutanic structure is the distinctive feature of these soils, the Rensburg Form comprises a vertic “A” horizon on a gleyed G-horizon;
- are generally pale in colour (grey to grey brown);
- have a high clay content often of a swelling variety;
- are highly leached; and
- the ERD are between 200 mm to 400 mm.

Sterkspruit (Ss) Swartland (Sw)

The Sterkspruit and Swartland Forms mapped within the surface use area comprise the following characteristics:

- blocky to prismatic in structure;
- are generally grey to dark brown or black in colour;
- returned evidence of expansive clays, and exhibits a 2:1 swelling;
- have low intake rates, moderate water holding capabilities; and
- with a fair range in ERD from 200 mm – 600 mm

Soil Physical Characteristics

Soil distribution

The distribution of the soils (Figure 6) is closely linked to the topography and parent materials from which they are derived. The better drained soils are generally associated with a less basic parent material; while the more structured and more clay rich (less easily drained) soils are associated with the intrusive, basic parent material which underlay the majority of the study area.

Soil erosion and compaction

The majority of the soils identified in the proposed project areas can be classified as having a moderate erodibility index (Table 10). This is largely ascribed to the generally low organic carbon content and the sensitivity of the soils (solubility of calcium). These factors are offset by the generally gentle to flat topography and the high clay contents. The vulnerability of the “B” horizon to erosion once/if the topsoil is removed must not be under estimated.

The wet and highly 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 10: ERODIBILITY OF DIFFERENT SOIL TYPES

Soil Form	Erodibility Index	Index of Erosion (I.O.E.)
Swartland	Moderate to High	1.40 – 1.65
Sterkspruit	Moderate	1.40 – 1.60
Arcadia	Moderate	1.40 – 1.65
Kroonstad	Moderate	1.40 – 1.65
Rensburg	Moderate	1.40 – 1.65
Witbank (man induced)	Variable	-

Dryland production potential

Soil forms can be classified as having a good dryland production potential if they exhibit an ERD of greater than 750 mm and a structure that is weaker than weak crumby.

The soil forms present in the proposed project areas are rated with wilderness or conservation status, with a strong to very strong structure (which has a restriction on the effective rooting potential), or restrictions based on the depth of soil to either bedrock or a restrictive layer. Soil forms Witbank, Arcadia, Rensburg, Sterkspruit and Swartland therefore have a moderate to low dryland production potential. Despite this moderate to low dryland production potential, there is evidence of dryland sunflower cultivation at the Shaft 16 WRD expansion site.

Irrigation potential

The irrigation potential for the soil forms identified within the project areas is poor due to the highly structured nature of the soil forms and the poor drainage capability. No irrigation activities are practised within the proposed project sites although areas adjacent to Impala's surface use area have been developed with both sprinkler as well as center pivot systems with moderate results on both the sandy clay loams as well as the more structured clay loams.

Soil utilisation potential

In general, the soils that have been disturbed or that might be impacted in the future, and that will require rehabilitation, are moderate to shallow, (Effective Rooting Depth (ERD) = 400 mm to 600 mm), generally poorly drained, with a susceptibility to erosion and compaction. The wet based and

structured soils will be difficult to work, both from a trafficability, workability, storage (stockpiling) 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 the soils are to be maintained.

The potential to use 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 lands (preferred option). The potential for economic farming of the structured soils is considered to be moderate to low.

Soil chemical characteristics

Soil salinity/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 aluminum 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.

Soil forms located within the project areas are neutral to slightly alkaline (7.0 to 8.3). It should however be noted that 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

Salinity and/or sodicity are important as it influences the 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.

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 clays it is 10 and for well drained, (red and yellow) soils and recent sands, 15.
Generally, soil forms within the project areas tend toward being saline in character, and may become susceptible to an increase in salinity if their water regime is not well managed. In addition these soil forms are slow draining.

Soil fertility

The soils identified within the project areas returned moderate to high levels of some of the nutrients required for good plant growth, although zinc, phosphorus and potassium are 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 are not generally considered to be of an arable land capability rating (strongly structured black tuffs and structured prisma-cutanic soil forms).

There are no indications of any toxic elements that are likely to limit natural plant growth in the soil forms located within the proposed project areas although the nitrate levels are generally higher than the average and at exceptionally high values could pose a problem. Fairly standard fertilizer 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 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 within the proposed project areas are high, due to the high clay content.

Conclusion

Soil forms found within the proposed project areas are predominately highly structured, relatively shallow soils with a high clay content which allows for high water retention. These soil forms are therefore not highly erodible but are susceptible to compaction. Poor drainage capacity of these soil forms reduces the dry production potential as well as the irrigation potential. These soil forms are difficult to work and have a limited utilisation potential. In addition, even though these soils are slightly alkaline in character and therefore promote good nutrient mobility, their soil fertility is low as a result of a deficiency of key nutrients.

These soils will require appropriate management measures during all phases to prevent losses from pollution, compaction and to a lesser extent erosion.

1.1.5 LAND CAPABILITY BASELINE

Information in this section was sourced from the Land Capability study conducted by Earth Science Solutions (ESS, February 2010).

Introduction and link to impacts

The land capability classification is based on the soil properties and related potential to support various land use activities. Mining operations have the potential to significantly transform the land capability. To understand the basis of this potential impact, a baseline situational analysis is described below.

Data collection

Land capabilities within the Impala surface use area were classified into different classes namely, wetland, grazing and wilderness by applying the classification system in terms of the South African Chamber of Mines Land Capability Rating System.

Results

The land capability classification as described above was used to classify the land units identified during the pedological survey. Figure 7 illustrates the distribution of land capability classes for the proposed project areas. Below is a description of the different land capability classes.

Arable

Although only a limited area could possibly classify (<1%) as having an arable land capability rating (based on depth limitations due to soil structure), the majority of the Shaft 16 WRD expansion site area has been successfully cultivated with sunflowers.

Grazing

The areas that classify as grazing land (limited) are generally confined to the shallower and transitional hydromorphic soil forms that are moderately well drained (see Section 1.1.4). Should there be rocks or pedocrete fragments present in the upper horizons of these soil groups, it will limit the land capability to wilderness land. Some parts of the proposed Pit8C and Shaft 16 WRD expansion sites have been classified as having a grazing land capability (Figure 7).

Wilderness/Conservation

The areas that classify as either conservation or wilderness land are found associated with the more structured, and shallower rocky soils. Although part of the proposed site for Pit8C has already been

disturbed by mining and agricultural acitvities, part of the site is classified as having a wilderness land capability (Figure 7).

Wetland

The soils are generally dark grey to black in the topsoil horizons, and high in transported clays, and can show pronounced mottling on gleyed backgrounds (pale grey colours) in the subsoils. These soils may occur within the zone of groundwater influence and/or in association with non-perennial surface watercourses. Although wetland potential soils have been mapped in part of the WRD expansion footprint, this area has mostly been transformed by extensive dryland sunflower cultivation and no evidence of any functioning wetland system was observed either by SLR or by DWA in their November 2011 site visit.

Evidence of misuse

The proposed project sites show signs of trampling by cattle but sheet-erosion and pedestalling appeared to be low, possibly on account of the extremely flat topography of the sites. There is evidence of overgrazing.

Conclusion

The current land capability within the proposed project Pit8C site is mostly grazing and wilderness. Given the temporary nature of the Pit8C project, the objective is to return the site as close as possible to its pre-disturbed land capability. In this regard, soil preservation is important if the land capability is to be appropriately reinstated.

The current land capability within the proposed Shaft 16 WRD site is mostly crop cultivation. Given the permanent nature of the Shaft 16 WRD project, the WRD will remain in perpetuity and the current land capability cannot be reinstated. At best, the site could be rehabilitated to a wilderness land capability, this too would require appropriate preservation of soils.

For both project sites, impact management and rehabilitation planning is required to achieve acceptable post rehabilitation land capabilities.

1.1.6 BIODIVERSITY BASELINE

Information in this section was sourced from the Biodiversity Study conducted by the North West University (NWU, November 2010).

Introduction and link to impacts

In the broadest sense, biodiversity provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. The known value of biodiversity and ecosystems is as follows:

- soil formation and fertility maintenance;

- primary production through photosynthesis, as the supportive foundation for all life;
- provision of food and fuel;
- provision of shelter and building materials;
- regulation of water flows and water quality;
- regulation and purification of atmospheric gases;
- moderation of climate and weather;
- control of pests and diseases; and
- maintenance of genetic resources.

The establishment of infrastructure as well as certain supportive activities have the potential to result in the loss of vegetation, habitat and related ecosystem functionality through physical disturbance and/or contamination of soil and/or water resources.

As a baseline, this section provides an outline of the type of vegetation occurring on site and the status of the vegetation, highlights the occurrence of sensitive ecological environments including sensitive/ endangered species (if present) that require protection and/or additional mitigation should they be disturbed.

Although the proposed Pit8C site has been disturbed by mining and agricultural acitivities, there are patches of vacant veld which are valuable in the sense that they provide linkages between undisturbed areas. No biodiversity of any consequence has been identified at the WRD expansion site. It is therefore not considered an important issue from the perspective of the impact assessment. It is however important to consider what the pre-disturbance natural vegetation would have been and use this information to design long term rehabilitation of the expanded section of the WRD.

Data collection - Vegetation

Standard surveying methods of acquiring existing data and sampling data based on a gap analysis were used in the investigations of the different organism groups. Complete species lists was obtained from the PRECIS (National Herbarium Pretoria (PRE) Computerized Information System (CIS)) held at SANBI in Pretoria. This database was augmented with species localities cited in relevant publication and reports.

Existing and sampled distribution data of plant species was merged with the PRECIS database. Species richness data was mapped, interpolated and illustrated using “Inverse Distance Weight” (IDW) spatial analysis tools in ArcView.

To classify the vegetation communities the Braun Blanquet approach was applied. Homogeneous units based on physiognomy and species composition were identified through visual observations during field work and aerial photography. Various computer databases were used to verify plant

communities and identify possible environmental gradients that could influence plant community structure and composition.

The analysis of landscape functionality was done using the Landscape Function Analysis method. This methodology consists of a conceptual framework, data acquisition through field procedure and data analysis and interpretation.

Data collection – Animal life

Data for the identification of small mammals was collected during day time collection of samples and night time observations that were conducted at seven different stratifications based on the habitats and plant species composition as discussed above over a set period of time.

Data relevant to bird identification was collected by means of on-site observations over four seasons. The surveys were devoted to the identification and counting of bird species. Data on the status, migration actions and endemic significance of each species was also collected. Other bird surveying techniques included transect sampling, patrolling and point counting.

Data relevant to the identification of amphibian species was collected during winter and summer in order to detect the winter and summer breeding species. Amphibian surveying techniques included aquatic traps, visual encounter sampling, dip net sampling, frog chorus monitoring and opportunistic search.

A total of 18 sites within the Impala surface use area were surveyed for the collection of reptile data. Presence/absence data for reptiles were gathered by employing opportunistic searches, stream and nocturnal searches and capture methods and handling techniques. Existing literature sources were used to aid in the identification of reptile species.

Data relevant to the identification of butterfly species was carried out by means of desktop reviews throughout the survey in order to accommodate and integrate all data that become available during the field observations. Numerous site visits were carried out in order to serve as a habitat survey that concentrated on the possible presence of butterfly species. Habitat characteristics and vegetation were investigated using field guides while butterfly species were identified during on site observations.

Results – Vegetation

Vegetation types

The Impala surface use area is located in the Savannah Biome. The Savannah Biome is the predominant biome of the region within which various vegetation types occur. The vegetation type occuring within the proposed Pit8C site and the small portion of vacant veld on which the Shaft 16 WRD project is to be located is the Marikana Thornveld. The distribution of this vegetation type is illustrated in Figure 8 and a more detailed discussion is provided below.

Marikana Thornveld

The Marikana Thornveld has been identified by the South African National Biodiversity Institute (SANBI) as an important thornveld requiring conservation and care. It is unclear whether the specific Pit8C project area falls within the NEMA protection areas because of mapping discrepancies. The Marikana Thornveld occurs on Plains from the Rustenburg area in the west, through Marikana and Brits to the Pretoria area in the east. The Marikana Thornveld is characterized by open *Acacia* Karroo woodland, occurring in valleys and slightly undulation plains and some lowland hills. The important tall tree species that occur in this vegetation type include the *Acacia burkei* while short tree species include *Acacia caffra, A. gerrardii, A karroo, Combretum molle, Searsia (Rhus) lancea, Ziziphus mucronata, Acacia nilotica, A. tortilis subsp. heteracantha, Celtis africana, Dombeya rotundifolia, Pappea capensis, Peltophorum africanum, and Terminalia sericea.* Tall shrubs that occur in the area include *Euclea crispa subsp. crispa, Olea europaea subsp. africana, Searsia pyroides var. pyroides, Diospyros lycioides subsp. guerkei, Ehretia rigida subsp. rigida, Euclea undulata, Grewia flava* and *Pavetta gardeniifolia.* Low shrubs that occur in the area include *Asparagus cooperi, Rhynchosia nitens, Indigofera* and *zeyheri, Justica flava.* Grasses that occur within this vegetation type include *Elionurus muticus, Eragrostis lehmanniana, Setaria sphacelata, Themeda triandra, Aristida scabrivalvis subsp. scabrivalvis, Fingerhuthia africana, Heteropogon contortus, Hyperthelia dissoluta, Melinis nerviglumis* and *Pogonarthria squarrosa.* Herbs (that occur in the area include *Hermannia depressa, Ipomoea obscura, Barleria macrostegia, Dianthus mooiensis subsp. mooiensis, Ipomoea oblongat and Vernonia oligocephala.* Geophytic herbs (herbs within underground storage units) that occur in the area include *Ledebouria revoluta, Ornithogalum tenuifolium* and *Sansevieria aethiopica.* Climbers that occur within this vegetation type include *Clematis brachiata, Helinus integrifolius, Pentarrhinum insipidium* and *Cyphostemma cirrhosum.*

Vegetation communities

Within Marikana Thornveld, there are different vegetation communities that form an integral part of the ecosystem. The flora study undertaken as part of the Biodiversity Study conducted by the North West University (NWU, November 2010) which covered the entire Impala surface use area identified a minimum of 155 plant species. The dominant vegetation communities located within the surface use area include:

- *Acacia Caffra-Bothriochloa Insculpta* Community
- *Aristidia Bipartita- Bothriochloa Insculpta* Community
- *Eragrostis Rigidor-Ziziphus Mucronata* Community
- *Indigofera Heterotricha-Aristida Bipartita* Community
- Disturbed Areas
- Norite Koppies Community
- Rehabilitated Zones Community
- Rockwell Dam (North) and Bospoort Dam (South); and

- Riparian areas

Whilst part of the Pit8C site has been transformed by existing Impala infrastructure and activities, the vacant areas do contain patches of natural vegetation of the *Indigofera Heterotricha-Aristida Bipartita* Community (Figure 9). Key aspects of this community are described below.

Indigofera heterotricha-Aristida bipartita vegetation community

This vegetation community has a typical savannah physiognomy (herbaceous component with prominent woody layers). Further detail of this plant community is provided below:

- located in the Zeerust, Marikana and Central Sandy Bushveld vegetation type.
- includes grass species *Sorghym versicolo, Ischaemum afrum;*
- trees include *Acacia nilotica, Acacia Tortilis;*
- include the forbs *Indigofera heterotricha* and *Sesbania tranvaalensis;*
- dominant species includes the grass Aristida Bipartits; and
- dominated by a 66% grass layer and a well-developed woody component that may exceed 30% cover, and a forb layer of approximately 10%. Dominated by woody component that makes up 67% of the plant community. Grass cover comprises 28% with forb cover of 9%.

In contrast, the natural vegetation at the Shaft 16 WRD expansion site has been transformed by dryland sunflower cultivation and the existing Shaft 16 WRD. In this regard, very little undisturbed veld remains. If this site had not been disturbed by these anthropogenic activities, it may have exhibited vegetation of the *Indigofera heterotricha-Arista bipartite* and Riparian communities.

Red data species

According to the the biodiversity study conducted by North West University (NWU, November 2010), the red data species *Boophone disticha* does occur within the *Indigofera heterotricha-Arista bipartita* vegetation community. It should however be noted that during the during field surveys conducted by the North West University, this red data species was not located within the footprint areas of the proposed Pit8C and Shaft 16 WRD sites.

Results – Animal life

Small mammals

The study conducted by the North West University over the general Impala mine lease area found that disturbance caused by existing mining and agricultural activities in the Pit8C and Shaft 16 WRD expansion areas respectively has resulted in fragmentation of the natural veld and only patches of undisturbed veld occur.

During the survey of the Impala surface use area, a total of 265 small animals were identified, consisting of 15 species. There are 7 species which could possibly occur in the Pit8C and Shaft 16 WRD project areas and these are summarised below (Table 11). The most common mammals

potentially occurring within the project areas are the Multi-mammate mouse, the Scrub Hare and the Slender Mongoose (Table 11). Table 12 lists the distribution of mammals that could potentially occur within the surface use area. It must however be noted that the occurrence of these mammal species is unlikely, particularly at the Shaft 16 WRD expansion site, given the extent to which the area has already been disturbed by current mining and agricultural activities. It is expected that given the current level of disturbance, mammal species would elect to reside elsewhere.

TABLE 11: MAMMALS IDENTIFIED WITHIN THE PIT8C AND SHAFT 16 WRD EXPANSION PROJECT AREAS

Scientific name	Common name	Number of individuals observed	Habitat location
Lemniscomys rosalia	Single-stripped mouse	4	Grasslands
Mastomys sp.	Multi-mammate mouse	89	Establish in areas recovering from habitat disturbance
Aethomys chrysophilus	Red veld rat	6	Grasslands, savannah woodlands and rocky outcrops
Thallomys paedulcus	Acacia rat	6	Savannah woodlands, especially areas dominated by *Acacia* trees.
Galerella sanguinea	Slender Mongoose	11	Forest to open savanna
Cynictis penicillata	Yellow Mongoose	9	Short grasslands
Lepus saxatilis	Scrub Hare	22	Dry open habitats

Mammals are located in areas where their favourable habitat exists and therefore certain species are specialised to live in certain conditions. Refer to Table 12 for the distribution of mammals within the proposed project areas. It is clear that each vegetation community has different species richness however in general relatively few small mammals were encountered. The reasons for this are as follows:

- destruction of habitat from the development of mining infrastructure;
- destruction of habitat from the development of community infrastructure;
- habitat fragmentation from the development of linear infrastructure such as roads, pipelines and railway lines; and
- transformation of habitat from land use activities such as grazing, wood harvesting, cultivation and fire burning.

TABLE 12: MAMMAL DISTRIBUTION WITHIN THE PIT8C AND SHAFT 16 WRD EXPANSION PROJECT AREAS

Plant community	Total number of animals	Total number of species
Indigofera heterotricha-Arista bipartita Community	24	6

No red data species in terms of SANBI red data list or protected species in terms of the Nature Conservation Ordinance (NCO, November 1983) were identified during the surveys.

Birds

A total number of 199 bird species were identified within the Impala surface use area according to the study conducted by the North West University (NWU, November 2010). Bird species that require protection in terms of the Nature Conservation Ordinance (NCO, November 1983) that may occur at the proposed Pit8C and Shaft 16 WRD projects sites are included in Table 13.

TABLE 13: PROTECTED BIRD SPECIES IN TERMS OF THE NATURE CONSERVATION ORDINANCE

Scientific name	Common name	Plant community
Streptopelia capicola	Cape turtle dove	*Indigofera heterotricha-Aristida bipartita* community
Streptopelia senegalensis	Laughing dove	*Indigofera heterotricha-Aristida bipartita* community
Corvus albus	Pied crow	*Indigofera heterotricha-Aristida bipartita* community
Passer melanurus	Cape sparrow	*Indigofera heterotricha-Aristida bipartita* community
Quelea quelea	Red-billed quelea	*Indigofera heterotricha-Aristida bipartita* community

Amphibians

Although a number of amphibian species have been identified across the Impala surface use area, it is not likely that these will occur at either project site because both sites are located adjacent to current mining activities and have also been disturbed by agricultural activities such as grazing and crop cultivation. In this regard, it is more than likely that amphibian species would reside elsewhere, where their habitat would be less susceptible to disturbances.

Reptiles

The reptiles which could potentially occur within the proposed project sites are listed in Table 14. No red data species in terms of SANBI red data list or protected species in terms of the Nature Conservation Ordinance (NCO, November 1983) were identified during the surveys.

TABLE 14: REPTILES IDENTIFIED IN THE SURFACE USE AREA

Scientific name	Common name
Pachydactylus affinis	Transvaal Thick toed Gecko
Chondrodactylus turneri	Turners Thick toad Gecko
Agama aculeata	Ground Agama
Agama atra	Southern Rock Agama
Trachylepis varia	Variable Skink
Trachylepis striata	Eastern Striped Skink
Leptotyphlops scutifrons	Peters' Worm Snake
Lamprophis fuliginosus	Brown House Snake
Psammophylax tritaeniatus	Striped Skaapsteker
Bitis arietans	Puff Adder

Butterflies

Habitat and vegetation characteristics play an important role in the diversity of butterfly species. Habitat structures such as rockiness, slope, plant structure and floristic composition influence the presence of butterfly species within a specific habitat as summarised in Table 15.

TABLE 15: BUTTERFLY DIVERSITY WITHIN PLANT COMMUNITIES

Plant community	Vegetation characteristics
Indigofera heterotricha – Aristida bipartite community	Most of the plains within the surface use area form part of this plant community. The natural grassy patches with the presence of numerous indigenous *Acacia* species form an ideal habitat for a wide variety of butterfly species.
Riparian community	Wetland fringes including those of the Rockwall dam, Bospoort dam, Channels and Seasonal drainage lines. The diversity of plant species along these fringes of water sources within the surface use area, is poor thereby reducing the occurrence of butterfly species within this plant community.

Given that the project areas are dominated by *Indigofera heterotricha – Aristida bipartite community,* the natural grassy patches with the presence of numerous indigenous *Acacia* species form an ideal habitat for a wide variety of butterfly species. A list of the butterfly species that could potentially occur within the proposed project sites are included in Table 16 below. As noted previously, both sites are located adjacent to current mining activities and have also been disturbed by agricultural activities such as grazing and crop cultivation. In this regard, it is more than likely that butterfly species would reside elsewhere, where their habitat would be less susceptible to disturbances.

TABLE 16: BUTTERFLY SPECIES THAT COULD POTENTIALLY OCCUR WITHIN THE PROPOSED PROJECT SITES

Scientific name	Common name
Eretis umbra umbra	Small Marbled Elf
Gegenes niso niso	Common Hottentot Skipper
Papilio demodocus	Citrus Swallowtail
Catopsilia florella	African Migrant
Colias electo brigitta	African Clouded Yellow
Belenois aurota aurota	Brown-veined White
Colotis entevippe gavisa	Red Tip
Colotis evinina evinina	Common Orange Tip
Colotis euippe omphale	Smoky Orange Tip
Pinacopteryx eriphia agathina	Zebra White
Pontia helice helice	African Meadow White
Acraea natalica natalica	Natal Acraea

Scientific name	Common name
Acraea serena	Small Orange Acraea
Danus chrysippus chrysippus	African Monarch
Junonia hierta	Yellow Pansy
Vanessa cardui	Painted Lady
Byblia ilithyia	Spotted Joker
Charaxes candiope	Greenveined Charaxes
Lachnocnema durbani	D'Urban's Woolly Legs
Alphnaeus hutchinsonii	Hutchinson's High-flier
Axiocerces tjoane tjoane	Common Scarlet
Crudaria leroma	Silver-spotted Grey
Anthene amarah amarah	Black-striped Hairtail
Azanus jesous jesous	Topaz-spotted Blue
Azanus moriqua	Thorn-tree Blue
Azanus ubaldus	Velvet-spotted blue
Chilades trochylus	Grass Jewwl Blue
Eicochrysops messapus mahallakoaena	Grassland Cupreous Copper
Lampides boeticus	Longtailed Pea Blue
Leptotes pirithous pirithous	Common Blue
Taracus Sybaris Sybaris	Dotted Blue

During surveys, conducted by the North West University (NWU, 2012), no red data species were identified within the surface use area. Threatened butterfly species that could potentially occur at the proposed project sites are included in Table 17. No protected species in terms of the Nature Conservation Ordinance (NCO, November 1983) were identified during the surveys.

TABLE 17: RED DATA BUTTERFLY SPECIES POTENTIALLY OCCURRING WITHIN THE PROJECT AREAS

Scientific name	Common name	Conservational status
Alaena margartiacea	Wolkberg Zulu	CR
Aloedes dentatis dentatis	Roodepoort Copper	VU
Aloeides stevensoni	Stevenson's Copper	VU
Anthene juanitae	Juanita's Ciliated Blue	VU
Chrysoritis aureus	Golden/Heidelberg Copper	VU
Dingana clara	Wolkberg Widon	VU
Erikssonia edgei	Edge's Acraea Copper	CR
Lepidochrysops lotana	Lotana Blue	CR
Lopidochrysops hypopolia	Morant's Blue	Extinct
Lepidochrysops praeterita	Highveld Blue	EN
Metisella meninx	March Sylph	VU
Orachrysops mijburghi	Mijburch's Blue	VU
Platylesches dolomitica	Dolomite Hopper	VU

Scientific name	Common name	Conservational status
Pseudonympha swanepoeli	Swanepoel's Brown	CR
Telchinia induna salmontana	Soutpansberg Acraea	VU

Conservation status, Red Data Categories: LC = least concern; NT = near threatened; EN = endangered VU = vulnerable; CR = critically endangered. Species group according to SANBI (2009) Red Data List.

Areas of high biodiversity and sensitivity in the Impala surface use area

Previous specialist studies (NWU, November 2010) have identified high biodiversity areas within the Impala surface use area that should be conserved where possible. These high biodiversity areas are illustrated in Figure 10. Neither the Pit8C nor Shaft 16 WRD expansion site fall within any of the identified high biodiversity areas.

Conclusion

Although the proposed Pit8C site has been disturbed by mining and agricultural acitivities, there are patches of vacant veld which are valuable in the sense that they provide linkages between undisturbed areas. These patches will require mitigation and/or rehabilitation as part of the development of the project.

No biodiversity of any consequence has been identified at the WRD expansion site. It is therefore not considered an important issue from the perspective of the impact assessment. It is however important to consider what the pre-disturbance natural vegetation would have been and use this information to design long term rehabilitation of the expanded section of the WRD.

1.1.7 SURFACE WATER BASELINE

Information for this section was sourced from site visits conducted by the EIA project team and the Surface Water Assessment for Floodline Modelling done for the Impala surface use area (Metago, September 2011)

Introduction and link to impacts

Surface water resources include drainage lines, paths of preferential flow of stormwater runoff as well as the channelling and/or collection of water on the surface such as irrigation canals and dams. Mine related activities have the potential to alter the drainage of surface water through the placement of both temporary (such as Pit8C and associated infrastructure) and permanent infrastructure (such as the Shaft 16 WRD expansion) and/or result in the contamination of the surface water resources through seepage and/or spillage of process materials, non-mineralised and mineralised wastes. To understand the basis of these potential impacts, a baseline situational analysis is described below.

Data Collection

Data used in determining the surface water characteristics include climatic data (section 1.1.2) and topographical data (section 1.1.3).

Rainfall and Evaporation data for the proposed site were considered from various sources including weather stations managed by both the SAWS and DWA. Mean annual precipitation (MAP) for the site was sourced from the Rustenburg-POL weather station (511400W).

The 24-hour design storm rainfall depths for various return periods were obtained from *"TR 102 - Southern African Storm Rainfall"*.

The mean annual runoff (MAR) was simulated using rainfall-runoff response parameters from Water Resource (WR) 2005. The rainfall-runoff response of the catchments was assumed to be the same as the regional rainfall-runoff response as determined for the specific quaternary catchments as set out in WR 2005.

Flow peak estimates within the proposed project areas were determined using the Rational Method. This method was selected to be the most appropriate since by using it, a combined approach could be implemented whereby flow in the headwaters of the sub-catchment could be calculated assuming dominant overland flow regime, while in the lower reaches, flow could be calculated with channel flow as the dominant regime. This method also allows for a composite estimation of the runoff coefficient, the influence of slope, soil permeability, vegetation and land cover to be considered.

Floodlines were determined for identified streams based on the latest contour survey obtained from the mine, as well as the appropriate 1:50 000 topographical maps and were modelled using RiverCad. These floodlines have been determined for both the 1:50 year and 1:100 year flood event.

Results

Catchments within the context of South Africa

The runoff from the proposed projects drains into the Elands and Hex Rivers catchments which in turn drain into the Crocodile River. The main dams downstream of Impala are the Vaalkop Dam on the Elands River and the Bospoort Dam on the Hex River.

Elands River Catchment

Runoff generated on main catchments B and C drains in a northerly direction into the Elands River (Quaternary Catchment A22F) and ultimately into the Vaalkop Dam. Catchment B drains into the Leragane stream, which flows into the Elands River. Catchment C is a small tributary which flows in the Leragane stream. The Eland's River Quaternary Catchment A22F feeds into the Limpopo River. Specific hydrological characteristics of these catchments are included in Table 18. The gross Mean

Annual Runoff (MAR) for the whole of quaternary catchment A22F is 14.4 million m^3 covering an area of 1 690 km^2 (WR 2005).

Hex River Catchment

Runoff generated on main catchment A drains in an easterly direction into the Bospoort dam, then into the Hex River (Quaternary Catchment A22H) and ultimately into the Vaalkop Dam. The Hex River Quaternary Catchment A22H also feeds into the Limpopo River. Specific hydrological characteristics of this catchment are included in Table 18. The gross MAR for the whole of quaternary catchment A22H is 15.7 million m^3 covering an area of 579 km^2 (WR 2005).

Catchment boundaries

The proposed Pit8C and Shaft 16 WRD project areas are drained by two separate quaternary catchments, Quaternary Catchment A22F and A22H respectively, both of which fall within the Limpopo A drainage region, as classified by WR90. The proposed project areas are drained by two main catchments, namely A and B which are illustrated in Figure 11. Specific catchment characteristics are included in Table 18.

TABLE 18: CATCHMENT CHARACTERISTICS

Catchment	Area (km^2)	Hydraulic Length (km)	Height Difference 10:85 (m)	Average Slope (m/m)	Time of Concentration (hours)
A	83	14	90	0.0086	3.16
B	273	42	178	0.0056	8.67

Mean annual precipitation and rainfall Depths

The average MAP for the proposed project areas are 658 mm. The average monthly rainfall and maximum one day rainfall is included in Table 19 and Table 20.

TABLE 19: MONTHLY RAINFALL DISTRIBUTION FOR THE RUSTENBURG-POL STATION

Month	Ave Rainfall Depth (mm) for Rustenburg POL
January	118.1
February	96.1
March	89.1
April	48.5
May	15.5
June	8.6
July	4.9
August	7.6
September	18
October	50.2
November	87.4
December	114.3

The highest intensity rainfall per month recorded for the Rustenburg-POL weather station was 384 mm in January 1909. The 24 hour rainfall depths for the Rustenburg POL weather station are included in

Table 20 *(TR 102 - Southern African Storm Rainfall).*

TABLE 20: THE 24-HOUR STORM RAINFALL DEPTHS FOR VARIOUS RETURN PERIODS FOR THE RUSTENBURG-POL STATION

Return period / recurrence interval (year)	24-hour rainfall depth (mm)
2	60
5	81
10	97
20	113
50	135
100	152
200	171

Mean Annual Run-off

Catchment B falls within Quaternary catchment A22F, with main Catchment A falling within Quaternary catchment A22H. The gross MAR for the whole of Quaternary catchment A22F and A22H are 14.4 million m^3 and 15.7 million m^3 respectively. The MAR for the major catchment areas are summarised below (Table 21).

TABLE 21: MEAN ANNUAL RUNOFF

Catchment	Area (km^2)	MAR (x 10^6 m^3/annum)
A	83	2.259
B	273	2.324

Flood peaks and volumes

The peak flow rates for the 1:50 and 1:100 year return period, as well as the regional maximum flood (RMF) are summarised in Table 22.

TABLE 22: CALCULATED FLOOD PEAKS

Catchment	Area (km^2)	Return period		
		1:50 (m^3/s)	1:100 (m^3/s)	RMF (m^3/s)
A	83	248	300	911
B	273	341	417	1652

Wetlands within the project areas

No wetlands were identified within any of the proposed project footprints (see correspondence with the DWA in Appendix A).

Surface water resources within the project areas

During various site visits, it was noticed that no flow/limited flow occurs across the Impala surface use area during the dry season. The streams are therefore considered to be non-perennial in nature as confirmed by the 1:50 000 topographical maps. Evidence of flow during the wet season was found in the larger streams. These are assumed to flow steadily following larger rainfall events, peaking for short periods.

The Pit8C project site is not located within the vicinity of any watercourses, it should however be noted that the diversion of clean water and the retention of water in dirty areas has the potential to impact on drainage patterns.

Following a site inspection by DWA in November 2011 (Appendix A), it was concluded that no watercourses (spring, wetland, river or stream) are located within the proposed Shaft 16 WRD expansion area. Despite this, runoff water (after rainfall events) is channelled along a preferential flow path within the cultivated sunflower fields and this runoff water will require diversion around the proposed WRD expansion for release through the downstream culverts that are located within the embankment of an internal Impala railway line.

Surface water use

Although many of the communities surrounding the proposed project sites have access to reticulated water supply, it is possible that surface water is abstracted from watercourses for domestic purposes and livestock watering. In addition, water in the Bospoort dam may be used for domestic, recreation and agricultural purposes.

Surface water monitoring and water quality

Impala has an on-going monitoring programme for surface water for the current mining operations. The purpose of this monitoring programme is to assess the potential impact of specific mining related activities, as well as the cumulative impact of the operation on surrounding surface water resources. The monitoring locations are described and presented in Section 21.

Multiple surface water monitoring locations make up the existing and proposed Impala surface water monitoring network. For the purposes of the Pit8C and Shaft 16 WRD expansions projects, the two most relevant monitoring points (namely Hosp/V-N and #16 Dowstream) are discussed below and show in Figure 19. These surface water monitoring points are located downstream of Pit8C and Shaft 16 respectively.

Data recorded at point Hosp/V-N shows elevated concentrations for most parameters. Data recorded at point #16 Dowstream shows elevated concentrations for Chloride, Nitrates, Calcium and Magnesium. It must be noted that limited data is available at this point given that the stream seldom flows. More sampling runs are required to provide a dependable dataset in future.

Relevant monitoring results are shown in Table 23 and sampling points are shown in Figure 19.

TABLE 23: SURFACE WATER QUALITY RESULTS

Description of sample		pH	EC	Cl	SO4	F	PO4	NO3	SAR	TDS	SS	Alk	Hard	Ca	Mg	Na	K	NH4	Pb	Fe	Ni	Zn	Cu	Mn	AL
			mS/m	mg/l	mg/l	mg/l	mg/l as P	mg/l as N		mg/l	mg/l	mg/l as CaCO3	mg/l as CaCO3	mg/l	mg/l	mg/l	mg/l	mg/l as N	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
	Domestic WQ Guidelines	**6-9**	**<70**	**<100**	**<200**	**<1**		**<6**						**<32**	**<30**	**<100**		**<1**	**<0.01**	**<0.1**		**<3**	**<1**	**<0.05**	
	WHO Drinking water (2008)			**250**		**1.5**		**11.3**						**300**		**200**			**0.0**		**0.07**		**2.00**	**0.40**	
	IFC Mining Efluent																		**0.2**	**2.0**	**0.50**	**0.50**	**0.30**		
	SANS class I		**<150**	**<200**	**<0.02**	**<0.1**		**<10**		**<1000**				**<150**	**<70**	**<200**	**<50**		**<0.02**	**<0.2**	**<150**	**<5**	**<1**	**<0.1**	**<300**
	SANS class II		**150 - 370**	**200-600**	**0.02-0.05**	**1.0-1.5**		**10-20.**		**100-2400**				**150-300**	**70-100**	**200-400**	**50-100**		**0.02-0.05**	**0.2-2**	**0.15-0.35**	**5-10.**	**1-2.**	**0.1-1**	**3 - 500**
	Livestock watering			**0-3000**	**0-0.1**			**0-1000**		**0-2000**				**0-1000**	**0-500**	**0-2000**			**0-0.1**	**0-10**	**0-1**	**0-20**	**0-1**	**0-10**	**0-5**
HOSP V.N	**Mean**	7.94	249.3	297.4	620.1	12.4	14.4	24.0	2.8	2210.8	40.5	213.7	952.0	181.6	129.9	199.1	22.7	0.598	0.104	0.322	0.850	0.092	0.121	0.150	0.382
	Max	9.20	879.0	720.0	1290.0	810.0	677.5	84.2	5.0	9000.0	950.0	585.0	2925.0	495.0	270.0	420.0	95.0	13.700	0.300	5.200	12.540	2.100	3.700	1.250	1.000
	Min	0.90	63.0	40.0	85.0	0.1	0.1	0.0	1.0	690.0	1.0	5.0	135.0	40.0	20.0	20.0	5.0	0.010	0.100	0.010	0.050	0.050	0.050	0.010	0.020
#16 DOWNSTREAM	**Mean**	7.35	821	2627	155	0.55	<0.1	63	2.75			50	3492	2365	130	382	18	0.1							<0.1
	Max	7.7	1103	3820	175	0.7	<0.1	120	3.4			65	4560	1610	130	530	20	0.1							<0.1
	Min	7	540	1436	135	0.4	<0.1	6	2.1			35	2425	755	130	235	15	0.1							<0.1

Floodlines

Floodlines for the proposed project areas are shown on Figure 12. The proposed Pit8C project site is not located within in the 1:100 year floodline or within 100m from any watercourses. Following a site inspection by DWA in November 2011 (Appendix A), even though the topographical map indicates the potential for a non-perennial drainage line, it was concluded that no watercourses (spring, wetland, river or stream) are located within the proposed Shaft 16 WRD expansion area. Despite this, runoff water (after rainfall events) is channelled along a preferential flow path within the cultivated sunflower fields and this runoff water will require diversion around the proposed WRD expansion for release through the downstream culverts that are located within the embankment of an internal Impala railway line.

Conclusion

Although there are no surface water resources located in the vicinity of the Pit8C project, there is the potential for contaminated surface water to reach downstream tributaries and ultimately the Leragane River. Despite DWA's conclusion that there are no watercourses located in the vicinity of the proposed Shaft 16 WRD expansion area, there is evidence of a preferential flow path which traverses the site and therefore there is the potential for contaminated surface water to reach downstream tributaries and ultimately the Bospoort Dam. In this regard, clean runoff patterns at both sites should be disturbed as little as possible to promote the continued flows of water and nutrients, and dirty water should be contained. This is relevant to both projects, given the level of existing downstream surface water contamination.

1.1.8 GROUNDWATER BASELINE

The information in this section was sourced from the groundwater specialist studies (Metago, September 2011, December 2011 and March 2012).

Introduction and link to impact

Groundwater is a valuable resource and is defined as water which is located beneath the ground surface in soil/rock pore spaces and in the fractures of lithologic formations. Activities such as the handling and storage of hazardous materials and handling and storage of mineralised and non-mineralised wastes have the potential to impact groundwater resources, both to the environment and third party users, through potential pollution. In addition, where mining requires dewatering in order to provide a safe working environment, there is the potential for a dewatering cone to develop and this can result in a loss of water supply to surrounding users. To understand the basis of these potential impacts, a baseline situational analysis is described below.

Data collection

Sources of data include the following:

- review of existing reports, databases (Impala's monitoring database and the National Groundwater database) and maps;
- geophysical investigations of certain areas; and
- hydrocensus studies of boreholes both within and outside of the Impala surface use area.

Results

Groundwater Zone (Aquifers)

The unweathered and fractured semi-confined bedrock aquifer consists of fractured norites, anorthosites and pyroxenites underlying the upper weathered aquifer. The intact bedrock matrix has a very low matrix hydraulic conductivity and its effective hydraulic conductivity is determined by fractures and mine voids. Groundwater flows through interconnected fracture systems with the potential of rapid vertical groundwater flow from the weathered overburden (and surface water bodies) to greater depths along interconnected conductive zones. The underlying solid and unweathered crystalline rocks are generally characterised by very low porosity and high hydraulic conductivity values if fractures are intersected. Water is generally stored and transmitted in fractures and fissures within a relatively impermeable matrix.

Based on the South African Aquifer Classification System (Parsons, 1995), the aquifer underlying the Impala surface use area is generally classified as a minor aquifer system. Within this minor aquifer system the possibility exists that there will be zones that can be classified as major aquifer systems. These zones are likely to be associated with geological features such as the Hexriver fault which is associated with significant volumes of poor quality water.

The definition of aquifer systems is as follows (Parsons, 1995):

- "A Minor Aquifer System can be fractures of potentially fractured rocks, which do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important both for local supplies and in supplying base flow to rivers".

- "A Major Aquifer System can be defined as highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good".

Vertical groundwater flow

The infiltration of water from the shallow weathered aquifer system to the deeper fractured bedrock aquifer system is strongly heterogeneous and requires permeable soils, or permeable horizons (i.e. 'infiltration routes'), as well as 'open' and interconnected fracture systems in the bedrock. Hydraulic continuity must exist between groundwater reservoir(s) in the overlying horizons (or weathered overburden) and the underlying bedrock. The fracture zones act as conduits for deeper flows from groundwater reservoirs located in upper permeable soils or the weathered overburden. The impacts

on the shallow weathered aquifer system may be negligible away from the immediate vicinity of the mining areas, given the hydrogeological characteristics of the weathered aquifer and the spatial heterogeneity in hydraulic connectivity between the shallow weathered aquifer and the deeper fractured aquifer. The general fact that the weathered and alluvial aquifers along the river courses support most irrigation and domestic water-supply boreholes despite being undermined by existing mines indicates limited interaction between the shallow and deep aquifer systems. Within the surface use area and immediately above under-mined zones, the shallow weathered aquifer may be drained due to slow vertical leakage to the dewatered, deeper fractured aquifer. However, the shallow aquifer has the potential to be replenished relatively quickly during sustained rainfall periods.

Horizontal groundwater flow

Due to local recharge and discharge, groundwater divides developed beneath the major surface water divides. Evidence of this is provided by a generally strong correlation between groundwater level elevation and topography and the observed groundwater flow directions. It can be assumed that the groundwater table follows the surface topography based on a very good correlation between the measured head and topography. In addition, horizontal groundwater flow is generally in accordance with surface water flow such that the regional groundwater flow is generally north-west and northwards towards the Elands River as well as south and south-east in the direction of the Bospoort Dam and Hex River.

Groundwater levels and yields

Impala's Groundwater Database indicates that groundwater levels in the shallow weathered aquifer vary between 3.7 and 19.3 mbgl (metres below ground level) with an average depth of 6.8 mbgl. The groundwater level for the deeper fractured aquifer varies between 9.3 and 48.6 mbgl with an average depth of 21.8 mbgl. The potential impacts associated with underground mine dewatering on groundwater levels within the shallow weathered aquifer is considered to be insignificant.

Groundwater monitoring and quality

Impala has an on-going groundwater monitoring programme that consists of more than 80 existing and proposed water monitoring locations which make up the Impala groundwater monitoring network. The groundwater monitoring programme is discussed in Section 21 and illustrated in Figure 18.

For the purposes of the Shaft 16 WRD expansion project, the three most relevant monitoring points (namely GCS 15, RGC16-1 and RGC16-3) are discussed below and show in Figure 18. These groundwater monitoring points are located to the north, west and south of the existing WRD. Data recorded at the downstream points (RGC16-1 and RGC16-3) shows elevated concentrations of Electrical Conductivity, Chloride, Sulphates, Nitrates, Total Dissolved Solids (TDS), Calcium and Magnesium.

For the purposes of the Pit8C project, the two most relevant monitoring points (namely 15D and 15S) are discussed below and show in Figure 18. These groundwater monitoring points are located to the north of the proposed site. Data shows elevated concentrations of Electrical Conductivity, Sulphates, TDS, Calcium and Magnesium.

The results of the selected monitoring boreholes for both the Pit8C and Shaft 16 WRD expansion project are shown in Table 24 below.

TABLE 24 SUMMARY OF GROUNDWATER QUALITY

		pH	EC	Cl	SO4	F	PO4	NO3	SAR	TDS	Tot Alk	Tot Hard	Ca	Mg	Na	K	NH4	Fe	Pb	Ni	Zn	Cu	Mn	Al
							mg/l				mg/l as	mg/l as					mg/l							
	Units		mS/m	mg/l	mg/l	mg/l	as P	N mg/l		mg/l	CaCO3	CaCO3	mg/l	mg/l	mg/l	mg/l	as N	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Groundwater Monitoring Point	Domestic Water Quality Objectives	6.0 - 9.0	<70	<100	<200	<1.0	-	<6	-	-	-	-	<32	<30	<100	<50	<1.0	<0.1	<0.01	-	<3	<1	<0.05	< 0.15
	WHO Drinking Water (2008)	-	-	250	-	1.5	-	11.3	-	-	-	-	300	-	200	-	-	-	0.01	0.07	-	2	0.4	
	IFC Mining Effluent	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	2	0.2	-	-	0.3	-	0
	SANS Class I	-	<150	<200	<400	<0.2	-	<10	-	< 1000	-	-	<150	<70	<200	<50	-	<0.2	<0.02	<0. 15	<5	<1	<0.1	<300
	SANS Class II	-	150 - 370	200 - 600	400-600	-	-		-	1000- 2400	-	-	150 - 300	70 -100	200 - 400	50 - 100	-	0.2 - 2	-	0.15 - 0.35	5 - 10.	1 - 2	0.1 - 1	0.3 - 0.5
	Livestock watering	-	-	0-3000	0-1000	-	-	0-100	-	0 - 2000	-	-	0-1000	0-500	0-2000	-	-	0-10	0-0.1	0-1	0-20	0-1	-	0-5
15D	Mean	8.0	212.2	207.7	555.2	0.6	0.9	0.9	1.1	1969.4	420.1	1025.4	186.8	137.0	93.2	8.0	0.2	1.45	0.11	0.08	0.06	0.06	0.40	0.02
	Max	9.0	453.0	500.0	1720.0	1.1	13.2	9.3	2.2	4090.0	1220.0	2495.0	385.0	370.0	190.0	25.0	1.4	9.60	0.30	0.36	0.14	0.16	3.38	0.02
	Min	7.4	69.0	25.0	30.0	0.1	0.1	0.1	0.0	950.0	170.0	330.0	70.0	35.0	10.0	5.0	0.1	0.01	0.10	0.05	0.05	0.05	0.01	0.02
15S	Mean	8.1	179.9	204.7	345.5	0.5	0.5	1.1	1.4	1527.3	339.9	763.9	133.4	104.5	89.5	9.3	0.2	0.36	0.11	0.06	0.05	0.06	0.16	0.02
	Max	8.9	361.0	300.0	745.0	0.9	9.4	8.9	5.3	2030.0	565.0	1235.0	225.0	170.0	195.0	65.0	0.8	2.80	0.30	0.14	0.10	0.10	1.14	0.02
	Min	7.3	88.0	40.0	30.0	0.2	0.1	0.1	0.0	550.0	80.0	265.0	5.0	45.0	10.0	5.0	0.1	0.01	0.01	0.05	0.05	0.05	0.01	0.02
GCS15	Mean	7.8	72.8	22.5	46.9	0.5	0.2	10.6	1.3	497.0	292.7	295.0	59.6	35.4	48.1	5.4	0.1	0.10	0.10	0.05	0.05	0.05	0.07	-
	Max	8.7	81.0	40.0	80.0	1.4	1.2	20.2	3.0	590.0	320.0	365.0	80.0	40.0	95.0	10.0	0.3	0.10	0.10	0.05	0.05	0.05	0.10	0.00
	Min	7.2	59.0	10.0	25.0	0.2	0.1	4.4	0.8	400.0	260.0	190.0	20.0	25.0	30.0	5.0	0.1	0.10	0.10	0.05	0.05	0.05	0.01	0.00
RGC 16-1	Mean	7.4	1094.4	3849.4	229.4	0.6	0.1	144.1	2.0	9400.0	148.3	5702.1	1602.2	413.3	328.3	8.9	0.1	0.12	0.17	0.09	0.07	0.06	0.13	-
	Max	7.9	2060	8115.0	265.0	0.8	0.1	560	3.9	18450	255.0	10880.0	3025	805.0	650.0	15.0	0.1	0.20	0.35	0.19	0.18	0.11	0.19	0.00
	Min	7.1	120.0	985.0	125.0	0.5	0.1	5.3	0.2	4090.0	105.0	2640.0	700.0	215.0	45.0	5.0	0.1	0.10	0.10	0.05	0.05	0.05	0.10	0.00
RGC 16-3	Mean	7.2	261.0	475.0	95.0	0.4	0.1	76.2	0.9	1850.0	215.0	1135.0	220.0	145.0	70.0	5.0	0.1	0.10	0.10	0.05	0.05	0.05	0.10	-
	Max	7.2	261.0	475.0	95.0	0.4	0.1	76.2	0.9	1850.0	215.0	1135.0	220.0	145.0	70.0	5.0	0.1	0.10	0.10	0.05	0.05	0.05	0.10	0.00
	Min	7.2	261.0	475.0	95.0	0.4	0.1	76.2	0.9	1850.0	215.0	1135.0	220.0	145.0	70.0	5.0	0.1	0.10	0.10	0.05	0.05	0.05	0.10	0.00

Groundwater use

More than half of the boreholes within the surface use area are used for groundwater monitoring while some of the existing boreholes are used for domestic, irrigation or livestock watering. Use of groundwater for domestic purposes is generally limited because communities within and outside the Impala surface use area generally have access to reticulated water supply.

From an ecological perspective, recent modelling indicates that groundwater does interact with the baseflow of surface water resources.

Conclusion

The nature of the Impala infrastructure and activities are such that they present real potential for pollution of groundwater resources that in some cases may be used by third parties for domestic, recreation and/or agricultural uses. This is applicable to both projects albeit that the WRD expansion project has longer term implications. In the case of dewatering, although this is unlikely, it requires assessment and mitigation planning.

1.1.9 AIR QUALITY BASELINE

Information in this section was sourced from the original Impala EMP (SRK, August 1997), the air quality specialist report compiled for the new tailings dam project that incorporates previous Airshed modelling for the smelter and other sources (Airshed, March 2012) and the Shaft 17 EMP amendment (Golder, September 2006).

Introduction and link to impact

Existing sources of emissions in the region and the characterisation of existing ambient pollution concentrations is fundamental to the assessment of cumulative air impacts. A change in ambient air quality can result in a range of impacts which in turn may cause a disturbance to and/or health impacts on nearby receptors. Receptor sites include the residential areas, communities and natural environments that have been described in Section 7.2.11. To understand the basis of these potential impacts, a baseline situational analysis is described below.

Data collection

Data was obtained from the review of existing literature, available studies and monitoring data, which includes meteorological data (weather data), dust fallout data, and selected ambient pollution concentration data (PM_{10} concentrations and dust fallout). This data was obtained from various ambient monitoring stations in and around Impala.

Results

Regional air quality

The contribution of various sources of emission to ambient particulate and gaseous concentrations within the Rustenburg region is of interest given that elevated concentrations have been recorded in and around the Rustenburg area. The most significant sources located within the Rustenburg region include:

- Stack, vent and fugitive emissions from *industrial* operations - industrial emissions include various criteria pollutants (as SO_2, NOx, CO and particulates), greenhouse gases (CO_2 and CH_4), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), various heavy metals and other toxins such as dioxins and furans. Industries in the region include three platinum smelter operations: Anglo Platinum Smelter Operation (Waterval Smelter), Impala Platinum Smelter Plant and Lonmin (Western Platinum). Sources of emission at these operations typically include stack emissions, including main stack releases which comprise furnace and converter offgases, acid plant stack emissions and releases from flash dryer stacks. The furnace and converter operations are also associated with fugitive emissions. A number of ferrochrome smelter operations also occur in the region. These include: International Ferro-metals near Mooinooi and Xstrata-Merafe Ferrochrome in Boshoek, Rustenburg, and Wonderkop. Furnace stack emissions, furnace fugitives and baghouse stack releases represent the main sources at these operations. The induction furnaces at Joerg Foundry (Trek Engineering) represent a smaller source of industry-related emissions.
- Stack emissions from boiler operations - boiler stack emissions include particulates, NOx, SO_2, CO, VOCs and CO_2. In addition to various industrial plants, boiler operations are also undertaken at Rainbow Chickens, Rustenburg Abattoir, MKTV Tobacco Limited, Rustenburg Provincial Hospital, British American Tobacco Products, Mageu Number One and Anglo Platinum Base Metals Refinery (BMR).
- Stack emissions from incineration operations - emissions include criteria gases (SO_2, NOx, CO, lead and particulates), acid gases (hydrogen chloride, hydrogen bromide, hydrogen fluoride) metal gases (chromium, arsenic, cadmium, mercury, manganese, etc.) and dioxins and furans. Incineration operations are undertaken at Anglo Platinum Precious Metals Refinery (PMR), with medical waste incineration occurring at Ferncrest Hospital.
- Fugitive emissions from quarrying and mining operations - comprising mainly dust releases, with small amounts of NOx, CO, SO_2, methane, CO_2 being released during blasting operations.
- Fugitive dust emissions from tailings impoundments which are associated with Anglo Platinum, Impala Platinum, Lonmin, Aquarius, Xstrata-Merafe, International Ferro-metals, Tharisa Minerals and Bafokeng Rasimone Platinum Mine.
- Vehicle tailpipe emissions - significant primary pollutants emitted by motor vehicles include CO2, CO, hydrocarbons (HCs), SO_2, NOx, particulate matter and lead.
- Household fuel combustion (coal, wood) - coal burning emits a large amount of gaseous and particulate pollutants including SO_2, heavy metals, total and respirable particulates including heavy metals and inorganic ash, CO, polycyclic aromatic hydrocarbons (PAHs), NO_2 and various

toxins such as benzo(a)pyrene. Pollutants from wood burning include respirable particulates, NO_2, CO, PAHs, particulate benzo(a)pyrene and formaldehyde. Particulate emissions from wood burning have been found to contain about 50% elemental carbon and about 50% condensed hydrocarbons.

- Biomass burning - major pollutants from veld fires are particulates, CO and VOCs. The extent of NOx emissions depend on combustion temperatures, with minor sulphur oxides being released.
- Various miscellaneous fugitive dust sources, including: agricultural activities, wind erosion of open areas, vehicle-entrainment of dust along paved and unpaved roads.

Ambient air pollutant concentrations within the Rustenburg region occur not only due to local source but also as a result of emissions from various remote sources. Regionally-transported air masses comprising well mixed concentrations of 'aged' (secondary) pollutants are known to represent a significant component of ambient fine particulate concentrations within the South African interior. Such air masses contain pollutants released from various remote sources including elevated releases from distant industrial operations and power generation facilities and large scale biomass burning in neighbouring countries. Typical pollutants which circulate within such regionally-transported polluted air masses include nitrates, ammonium nitrate and sulphates. The quantification of background particulate concentrations is complicated due to the large number of sources. Sources of particulates also include a significant proportion of fugitive emissions from diffuse sources (e.g. vehicle-entrained dust from roadways, wind-blown dust from stockpiles and open areas, dust generated by materials handling) which are more difficult to quantify than are emissions from a point source.

Local air quality

The key operations and activities that contribute to the air pollution within the Impala surface use area include:

- point source emissions from listed activities at the smelter operations (stack and fugitive emisssions);
- ventilation emissions from underground mine workings (NO_x, CO_x and particulates);
- open cast operations;
- dust generated from the tailings dams and spills along the delivery pipelines.
- diesel generators;
- vehicle tailpipe emissions;
- materials handling operations (e.g. crushing, tipping of waste rock and ore, conveying of ore, stockpiles);
- vehicle activity on paved and unpaved roads (during construction, operation and decommissioning); and
- wind erosion from exposed working surfaces.

These emissions contribute towards both nuisance value, mainly in the immediate area of the source (large particle deposition) and potential increased health impacts (PM_{10} in particular).

Potential receptor sites

There are numerous sensitive receptor sites that may be susceptible to air pollution within and surrounding the surface use area. Given that both proposed project sites are located adjacent to existing mining activities and infrastructure, it is proposed that there will be no material change in the air pollution as a result of their development. In addition to this, the expanded section of the WRD at Shaft 16 will in fact be further away from Kanana than the existing WRD which is currently in use.

Ambient PM_{10} concentrations

Impala Platinum operates various ambient monitoring stations which provides a good indication of ambient concentrations attributed to various activities and sources in and around Impala's area of operation. Various meteorological parameters as well as PM_{10} are measured at three stations located in Boshoek, Luka, and Central Services. A summary of ambient PM_{10} concentrations recorded at Central Services for the period January 2009 to June 2012 is provided in Table 25 (Airshed, March 2012).

Central Services monitoring station discussion

The annual average ambient PM_{10} concentration (for 2009) was calculated to be in order of 46.3 µg/m³. This exceeded the National Ambient Air Quality Standards of 40 µg/m³ which comes into effect in January 2015. The national daily limit value (which comes into effect in January 2015) of 75 µg/m³ was exceeded a total of 48, 75 and 68 days during 2009, 2010 and 2011 respectively. The highest ambient PM_{10} concentrations were recorded from June to November each year indicating that a clear seasonal variation in PM_{10} concentration is distinguishable. The highest ambient PM_{10} concentrations were associated with winds from the south-west, south-southwest, and south.

TABLE 25: SUMMARY OF AMBIENT PM_{10} CONCENTRATIONS AS RECORDED FROM JANUARY 2009 TO JULY 2012

Ambient Monitoring station	**Year**	**Annual Average Concentration [ug/m^3]**	**Highest daily concentration [ug/m^3]**	**Frequency of exceedance 75 ug/m^3 [days]**	**Data availability**
*Ambient air quality standard**		*2011– 50*ug/m^3 *2015-40*ug/m^3	*2011–120*ug/m^3 *2015-75*ug/m^3	*4 days per year*	*Not applicable*
Central services	2009	46.3	130	48	98%
	2010	54.2	191	75	91%
	2011	49.5	196	68	96%
	2012 (until June)	26.4	98	1	99%

*NEM: AQA – National Ambient Air Quality Standards, GN 1210, December 2009

Dust fallout

Impala operates an extensive network of dust buckets for the purpose of monitoring monthly fallout in and around the area of operation. A summary of dust fallout collected from December 2009 to June 2012 is provided in Table 26. The level of dust deposition is evaluated against the South African National Standards (SANS 1929:2005) guidelines. Dust fallout monitoring points closest to the proposed Pit8C project are Impala Main Gate, East Plant Area and 4 Shaft Residential. With regards to the Shaft 16 WRD expansion project, the most relevant monitoring points are Sites 3, 4 and 5 at Shaft 17. Whilst dust fallout concentrations at these monitoring stations and others within the Impala surface use area are generally kept within the SANS dust fallout guideline limits, results indicate some exceedances of both the residential 600 mg/m²-day and industrial 1 200 mg/m²-day guideline (SGS, October 2011, August 2012).

TABLE 26: SUMMARY OF DUSTFALL RESULTS (DEC 2009 – JUNE 2011)

Type	Site Description	Site ID	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec- 10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11
Industrial	Shaft 9	IMP 1	90	34	303	256	22	41	169	21	88	144	206	85	159	60	141	121	47	17	59
Industrial	Shaft 15	IMP 2	423	215	581	866[a]	281	313	881[a]	730[a]	875[a]	830[a]	828[a]	577	197	204	431	220	397	235	645[a]
Industrial	Shaft 10	IMP 3	172	90	88	208	60	58	97	98	98	138	273	543	135	63	128	7	92	47	120
Industrial	UG2 Concentrator	IMP 4	67	29	67	157	296	29	61	93	129	197	271	547	71	n/d	8	43	68	n/d	217
Industrial	Shaft 4	IMP 5	30	23	40	80	33	42	41	51	55	22	275	253	102	22	213	95	28	31	72
Industrial	Northern Penstock	IMP 6	1 801[b]	144	126	93	36	31	51	43	56	114	302	128	134	415	337	107	56	32	65
Residential	Luka South	IMP 7	26	91	82	240	96	43	45	49	62	87	287	398	110	41	60	8	68	15	100
Residential	Luka Primary	IMP 8	n/d	112	1 039[a]	n/d	483	51	n/d	169	69	164	n/d	152	n/d	28	69	123	60	51	38
Residential	Luka North	IMP 9	110	102	29	109	54	84	48	136	134	113	405	379	117	28	120	21	45	82	198
Residential	Boshoek Primary	IMP 10	115	229	203	192	379	220	332	217	212	351	561	399	78	124	263	119	31	98	147
Industrial	Shaft 17 Site 1	IMP 11	139	134	163	297	41	103	92	159	137	168	212	167	36	34	75	64	81	231	149
Industrial	Shaft 17 Site 2	IMP 12	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	193	198	382	169	113	19	127	58	25	39	340
Industrial	Shaft 17 Site 3	IMP 13	95	43	42	197	516	128	103	31	120	240	128	329	7	89	44	69	341	48	159
Industrial	Shaft 17 Site 4	IMP 14	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	240	120	255	277	407	n/d	74	17	n/d	n/d	202
Industrial	Shaft 17 Site 5	IMP 15	96	58	59	107	20	47	48	n/d	169	120	151	1 549[b]	72	32	88	10	44	20	36
Industrial	Shaft 17 Site 6	IMP 16	105	408	36	215	32	34	83	124	117	136	229	522	171	n/d	13	37	71	38	n/d
Industrial	Shaft 17 Site 7	IMP 17	335	136	123	106	232	269	244	65	146	168	154	121	219	35	29	16	n/d	24	42
Industrial	Shaft 17 Site 8	IMP 18	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	151	84	64	150	176	66	231	259	n/d	n/d	47
Residential	Phokeng Village	IMP 19	69	27	16	106	25	28	36	23	68	137	86	105	71	34	40	28	19	17	27
Residential	Luka Village Tailings	IMP 20	105	49	32	217	27	45	91	35	141	230	238	278	14	25	80	37	50	22	87
Residential	Luka Village Shaft 17	IMP 21	70	31	34	39	35	48	38	51	221	140	267	367	147	53	140	33	55	138	120
Industrial	Northern side No 3/4 tailings	IMP 22	623[a]	n/d	n/d	n/d	n/d	n/d	n/d	n/d	33	157	168	168	348	91	44	56	65	17	47
Industrial	Southern side No 3/4 tailings	IMP 23	327	731[a]	214	189	46	60	76	105	35	439	1 240[b]	3 052[b]	113	397	160	95	43	23	234
Residential	Meriteng Village	IMP 24	20	15	17	106	12	26	82	39	24	15	115	94	78	51	112	19	128	15	36
Industrial	UG2 Concentrator Tailings Line 1	IMP 25	177	70	36	417	38	65	93	184	92	296	n/d	1 287[b]	243	114	329	254	103	109	114
Industrial	UG2 Concentrator Tailings Line 2	IMP 26	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	38	124	183	267	241	11067[b]	158	75	83	34	54
Industrial	West Slag Dump	IMP 27	50	55	39	149	123	n/d	18	92	n/d	177	156	n/d	42	14	15	108	n/d	99	66
Industrial	North Central Concentrator Area	IMP 28	1 024[a]	33	63	1 000[a]	1 242[b]	283	1 498[b]	2 070[b]	763[a]	1 435[b]	226	169	260	735	401	42	442	321	51
Industrial	East Central Concentrator Area	IMP 29	263	158	26	188	76	121	222	171	122	211	283	497	692	128	87	87	319	45	163
Industrial	South Central Concentrator Area	IMP 30	162	308	71	254	58	82	94	46	106	199	289	622[a]	191	64	61	62	92	104	67
Industrial	West Central Concentrator t Area	IMP 31	1 709[b]	626[a]	439	935[a]	1 232[b]	1 186[a]	727[a]	502	361	1 989[b]	1 188[a]	1 858[b]	751	488	411	760	367	286	698[a]
Industrial	Impala Processing Main Gate	IMP 32	827[a]	n/d	n/d	n/d	n/d	n/d	n/d	265	600[a]	n/d	n/d	630[a]	181	429	608	673[a]	196	262	592
Industrial	Shaft 11	IMP 33	2 644[b]	n/d	n/d	4 111[b]	697[a]	642[a]	1 237[b]	1 010[a]	1 189[a]	1515[b]	781[a]	483	81	1215[b]	1089[a]	379	390	60	358
Industrial	Shaft 7	IMP 34	135	22	71	72	14	125	92	36	41	95	118	186	41	28	n/d	22	80	111	36
Industrial	Impala Opencast	IMP 35	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	121	92	127	145	21	25	167	44	52	30	74
Residential	Freedom Park	IMP 36	236	170	80	8	240	143	216	88	51	178	177	239	315	n/d	54	194	142	137	192

(SGS, October 2011)

Notes:

(a) Exceeds the SANS residential dust fallout limit of 600 mg/m²-day

(b) Exceeds the SANS industrial dust fallout limit of 1 200 mg/m²-day

n/d: Not data

TABLE 27: SUMMARY OF DUSTFALL RESULTS (JULY 2011 – JUNE 2012)

Type	Site Description	Site ID	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec- 11	Jan-12	Feb- 12	Mar-12	Apr-12	May-12	Jun-12
Industrial	Shaft 9	IMP 1	50	182	324	391	419	42	355	n/d	124	229	371	31
Industrial	Shaft 15	IMP 2	624[a]	718[a]	889[a]	1070[a]	672[a]	301	966[a]	n/d	1037[a]	900[a]	1023[a]	542
Industrial	Shaft 10	IMP 3	63	89	655[a]	348	405	23	971[a]	n/d	240	246	399	134
Industrial	UG2 Concentrator	IMP 4	53	291	784[a]	530	886[a]	159	579	n/d	200	294	219	316
Industrial	Shaft 4	IMP 5	39	36	674[a]	361	364	44	421	n/d	265	193	68	89
Industrial	Northern Penstock	IMP 6	30	39	234	256	375	129	3792[b]	n/d	200	54	86	51
Residential	Luka South	IMP 7	41	131	376	460	198	122	351	n/d	257	125	107	34
Residential	Luka Primary	IMP 8	26	263	437	274	408	n/d	328	n/d	286	89	101	57
Residential	Luka North	IMP 9	135	255	516	446	369	119	116	n/d	164	138	552	171
Residential	Boshoek Primary	IMP 10	106	127	409	367	349	144	170	n/d	304	88	106	282
Industrial	Shaft 17 Site 1	IMP 11	90	129	452	377	115	304	527	n/d	316	205	369	133
Industrial	Shaft 17 Site 2	IMP 12	142	261	443	415	106	109	298	n/d	253	408	110	162
Industrial	Shaft 17 Site 3	IMP 13	42	20	n/d	n/d	635[a]	596	369	n/d	238	276	563	54
Industrial	Shaft 17 Site 4	IMP 14	115	394	520	349	n/d	795[a]	629[a]	n/d	773[a]	182	11	219
Industrial	Shaft 17 Site 5	IMP 15	57	175	339	387	409	26	100	n/d	384	315	211	65
Industrial	Shaft 17 Site 6	IMP 16	162	210	903[a]	898[a]	896[a]	690[a]	334	n/d	393	190	189	64
Industrial	Shaft 17 Site 7	IMP 17	133	407	466	731	205	938[a]	580	n/d	461	206	117	362
Industrial	Shaft 17 Site 8	IMP 18	9	224	504	1170[a]	309	147	606[a]	n/d	167	248	221	552
Residential	Phokeng Village	IMP 19	44	120	292	269	248	29	19	n/d	144	66	41	27
Residential	Luka Village Tailings	IMP 20	47	82	278	306	178	108	231	n/d	215	22	138	49
Residential	Luka Village Shaft 17	IMP 21	45	162	413	160	197	99	233	n/d	252	29	112	29
Industrial	Northern side No 3/4 tailings	IMP 22	427	122	473	687[a]	66	257	n/d	n/d	n/d	n/d	n/d	77
Industrial	Southern side No 3/4 tailings	IMP 23	n/d	742[a]	1181[b]	428	1106[a]	138	450	n/d	545	1192[b]	725[a]	136
Residential	Meriteng Village	IMP 24	20	66	307	330	451	30	283	n/d	201	87	78	14
Industrial	UG2 Concentrator Tailings Line 1	IMP 25	87	252	260	550	248	190	591	n/d	221	514	329	163
Industrial	UG2 Concentrator Tailings Line 2	IMP 26	38	207	359	224	221	215	484	n/d	399	89	85	165
Industrial	West Slag Dump	IMP 27	31	131	323	762[a]	373	94	164	n/d	390	226	351	66
Industrial	North Central Concentrator Area	IMP 28	122	557	482	391	326	82	671[a]	n/d	923[a]	408	1471[b]	587
Industrial	East Central Concentrator Area	IMP 29	145	166	643[a]	532	419	357	760[a]	n/d	302	220	86	155
Industrial	South Central Concentrator Area	IMP 30	65	136	984[a]	279	281	85	100	n/d	401	91	81	54
Industrial	West Central Concentrator t Area	IMP 31	8	755[a]	1540[b]	1094[a]	873[a]	295	744[a]	n/d	682[a]	397	868[a]	1833[b]
Industrial	Impala Processing Main Gate	IMP 32	352	n/d	1138[a]	1212[b]	1285[b]	715	889[a]	n/d	727[a]	n/d	571	566
Industrial	Shaft 11	IMP 33	483	359	n/d	2146[b]	n/d	n/d	2476[b]	n/d	692[a]	952[a]	722[a]	n/d
Industrial	Shaft 7	IMP 34	74	34	233	188	194	104	354	n/d	275	160	155	51
Industrial	Impala Opencast	IMP 35	52	74	347	557	252	108	287	n/d	346	54	182	86
Residential	Freedom Park	IMP 36	67	58	383	430	483	200	195	n/d	163	254	138	30

(SGS, August 2012)

Notes:

(a) Exceeds the SANS residential dust fallout limit of 600 mg/m²-day

(b) Exceeds the SANS industrial dust fallout limit of 1 200 mg/m²-day

n/d: Not data

Conclusion

Impala is situated within a region with already elevated ambient air pollution. Recorded ambient PM_{10} concentrations do occasionally exceed the proposed relevant standards/guideline limit values. Dust fallout concentrations within the Impala surface use area are generally kept within the SANS dust fallout guideline limits with some exceedances recorded from time to time. Management measures for current mining activities need to be complied with at all times to effectively manage operational contributions to ambient PM_{10} concentrations and dust fallout.

When Pit8C becomes operational, the emissions to air (in the greater Impala mine area) that are associated with the current operational pits will cease and be replaced by similar emissions for Pit8C. In this regard the Pit8C project is unlikely to result in any material changes to localised air impacts. Moreover, the proposed Pit8C is not located adjacent to any third party receptors.

Once the the expanded section of the WRD is operational, the current older section will no longer be used and emissions to air associated with expanded WRD will merely replace those which were previously generated by the existing WRD. In this regard, the Shaft 16 WRD expansion project is unlikely to result in any material changes to localised air impacts. Although Kanana, as a third party receptor is located within close proximity to the proposed WRD expansion site, it must be noted that the emissions to air generated by the WRD expansion will be negligible and it is not expected that impacts will be felt by the community members at Kanana.

1.1.10 NOISE

Information in this section was extracted from the Shaft 17 EMP amendment (Golder, September 2006) and the noise assessment compiled for the tailings dam projects and open pit expansions (Airshed, March 2012).

Introduction and link to impact

Certain noise generating activities associated with the Impala mining operations can cause an increase in ambient noise levels in and around the site. This may cause a disturbance to nearby receptors. Potential receptor sites include the residential areas and communities that have been described in Section 1.3.4 To understand the basis of these potential impacts, a baseline situational analysis is described below.

Data collection

Information provided in this report on the current day and night ambient noise levels, was collated during noise monitoring that was undertaken at several sampling sites located within the Impala surface use area. These sampling points were identified to provide a representation of ambient noise levels. The monitoring was conducted for a 24-hour period where possible. Meteorological conditions and the

location of sampling points were taken into consideration when determining ambient noise levels. A summary of the findings is provided below.

Results-Pit8C

Areas in close proximity to mining operations

Day-time ambient noise levels range from 35.3 dBA to 59.7 dBA with an average of 41.6 dBA. Exceedance of the SANS day-time rating of 55 dBA (SANS10103, 2008) for urban districts, occurs along roads and in the immediate vicinity of railway lines, ventilation infrastructure and shafts. Noise levels are greatly affected by Impala ore hauling trains, specifically by the intermittent but frequent train warning hooters.

Night-time ambient noise levels range from 38.7 dBA to 66.6 dBA with an average of 49.3 dBA. Exceedance of the SANS night-time rating of 45 dBA (SANS10103, 2008) for urban districts occurs along roads and in the immediate vicinity of railway lines, ventilation infrastructure and shafts. Noise levels are greatly affected by Impala ore hauling trains, specifically by the intermittent but frequent train warning hooters. Conditions during night-time hours result in reduced atmospheric noise attenuation and therefore higher ambient noise levels.

Results-Shaft 16 WRD expansion

Semi-rural environment

Ambient noise levels that are associated with the isolated mining activities such as shaft operations as well as the presence of communities are discussed below.

Day-time noise levels range from 43 dBA – 52 dBA with an average of 48 dBA which does exceed the SANS day-time rating of 50 dBA. Night-time noise levels before 22h00 range from 42 dBA – 46 dBA with an average of 44 dBA and therefore does not exceed the SANS day/night-time rating of 50 dBA. Night-time noise levels (after 22h00) fall even lower to a range of between 37 dBA to 40 dBA which is below the SANS night-time threshold of 40dBA.

Conclusion

Areas that are located in close proximity to mining activities have elevated ambient noise levels. Given that the proposed site for Pit8C is located immediately adjacent to noise generating mining activities, the noise environment has already been altered and as such it is not expected that the development of Pit8C will result in an increase in noise disturbance. Further to this, the proposed Pit8C is not located adjacent to any third party receptors, thereby further reducing the potential noise impacts associated with the project.

Similarly, the proposed site for the Shaft 16 WRD expansion is located adjacent to Shaft 16 and current WRD. Although the Shaft 16 WRD site is located within close proximity to the Kanana community, the

expanded section will be located further from Kanana than the current WRD. In light of this, as well as the fact that when the proposed WRD expansion is operative the current older section will no longer be used, it is expected that the noise environment will remain largely unchanged or may even improve.

1.1.11 VISUAL LANDSCAPE

Introduction and link to impact

Mining infrastructure has the potential to alter the landscape character of the site and surrounding area through the establishment of both temporary (such as the opencast pit and associated infrastructure) and permanent infrastructure (such as the WRD expansion). To understand the basis of these potential impacts, a baseline situational analysis is described below.

Data collection

Data collection was sourced from on-site observations and the review of relevant maps.

Results

The various aspects of the visual baseline are set out below.

Landscape character

The landscape character of the Impala surface use area is defined by gentle undulating plains, koppies, communities and mining infrastructure. In addition, it is important to provide the project area context. Due to Impala's surrounding mining activities as well as ad-hoc grazing activities the proposed natural vegetation at the proposed Pit8C project site has been significantly disturbed and fragmented. Similarly, the proposed Shaft 16 WRD expansion site has generally been disturbed and fragmented as a result of current mining activites and crop cultivation activities.

Scenic Quality

The scenic quality is linked to the type of landscapes that occurs within an area. Scenic quality ranges from high to low as follows:

- **high** – these include the mountains and koppies, water bodies such as farm and irrigation dams, and natural drainage systems;
- **moderate** – these include agricultural activities and recreational areas; and
- **low** – these include towns, communities, roads, railway line, industries and existing mines.

When these landscape types are considered as a whole, the overall scene is characterised by open views with degraded grass fields, cultivated agricultural fields and mining structures and activities that dominate the scene. The result is that the overall scenic value of the landscape at both sites is considered to be low.

Sensitivity of Visual Resource

Given the low scenic value associated with the proposed Pit8C and Shaft 16 WRD expansion project areas, these areas are the least sensitive to change such as the mining and community areas.

Sense of Place

The sense of place results from the combined influence of landscape diversity and distinctive features. Given the dominance of the mining, agricultural activities, community infrastructure, and the lack of landscape diversity and distinctiveness, the overall sense of place for the proposed project sites is moderate to low.

Visual receptors

When viewed from the perspective of tourists and community members, mining activities could be associated with a sense of disenchantment. People who benefit from Impala (employees, contractors, service providers etc.) may not experience this disenchantment but rather see the mine with a sense of excitement and anticipation.

It follows that the sensitive viewer locations are those situated within the vicinity of undisturbed natural areas or on surrounding transport routes (particularly those that are used to reach tourist destinations). The less sensitive viewer locations are from within the mining areas along roads and railways that service the mines.

Conclusion

When considering landscape character, scenic quality, visual resource, sense of place and visual receptors the baseline conclusion is that the proposed sites for Pit8C and Shaft 16 WRD expansion are located in areas which have already been disturbed by mining and agricultural activities, it follows that the visual impact associated with these developments will be negligible.

1.2 ENVIRONMENTAL ASPECTS WHICH MAY REQUIRE PROTECTION OR REMEDIATION

Environmental aspects which may require protection or remediation are listed below. The list is based on the concise descriptions provided in Sections 1.1 and 1.3.

- Hazardous excavations and infrastructure (applicable to both Pit8C and Shaft 16 WRD expansion)
- Loss of soil resources and land capability through pollution and/or physical disturbance (applicable to both Pit8C and Shaft 16 WRD expansion)
- Disturbance of biodiversity (applicable to Pit8C only)
- Pollution of surface water resources (applicable to both Pit8C and Shaft 16 WRD expansion)
- Alteration of natural drainage patterns (mostly applicable to Shaft 16 WRD expansion)
- Contamination of groundwater (applicable to both Pit8C and Shaft 16 WRD expansion)

- Air pollution (applicable to both Pit8C and Shaft 16 WRD expansion)
- Blasting damage (applicable to Pit8C only)
- Road disturbance and traffic safety (applicable to both Pit8C and Shaft 16 WRD expansion)
- Visual (applicable to both Pit8C and Shaft 16 WRD expansion)
- Economic impact (positive and negative) (applicable to both Pit8C and Shaft 16 WRD expansion)
- Inward migration impact (applicable to both Pit8C and Shaft 16 WRD expansion)
- Land use impacts (applicable to both Pit8C and Shaft 16 WRD expansion)

1.3 LAND USES, CULTURAL AND HERITAGE ASPECTS AND INFRASTRUCTURE

A description of the specific land uses, cultural and heritage aspects and infrastructure on site and on neighbouring properties/farms is provided in this section. This section identifies whether or not there is potential for the socio-economic conditions of other parties to be affected by the proposed projects.

1.3.1 CULTURAL ASPECTS

Cultural aspects of the proposed project areas are discussed below as part of the heritage discussion.

1.3.2 HERITAGE BASELINE (INCLUDING CULTURAL RESOURCES)

Information in this section was sourced from the Heritage Impact Assessment study included in Appendix E (Julius Pistorius, September 2012) and the Heritage Survey and Assessment (Julius Pistorius, May 2011).

Introduction and link to impacts

The proposed projects have the potential to impact heritage, cultural and palaeontological resources through the placement of infrastructure and through the related construction and operational activities. To understand the basis of these potential impacts, a baseline situational analysis is described below.

Data Collection

Data collection comprised three key activities:

- literature review to ascertain the historical context;
- interrogation of the heritage databases that are maintained by North-West Provincial Heritage Resources Agency (NW PHRA) in Mafikeng and the Archaeological Data Recording Centre at the National Flagship Institute (Museum Africa) in Pretoria; and
- field surveys.

Results – Heritage and cultural resources

Impala is located within the Central Bakenveld. The Bakenveld is a narrow strip of land between the Northern Bushveld Savannah and the centrally situated Highveld. The proposed project areas are situated between the Magaliesberg in the West and the series of Norite Koppies running from Thekwane in the South to near the Pilanesberg in the North. This area is known for its rich and diverse range of heritage resources stone age and late iron age sites. The proposed project sites are located in the heartland of the former sphere of influence of the Late Iron Age and historical Bafokeng people.

Although the proposed Pit8C and Shaft 16 WRD expansion project areas fall within a region that is known to have heritage and cultural resources, the heritage and cultural survey conducted for the proposed projects revealed no heritage or cultural resource findings.

Results – Palaeontological

The palaeontological study indicates that the proposed project areas are situated on underlying igneous rocks of the Precambrian Rustenberg Layered Suite of the BIC (Section 1.1.1), and that palaeontological resources are not associated with this underlying geology. It is therefore unlikely that the proposed projects will have any palaeontological impacts.

Conclusion

No heritage, cultural and palaeontological resources have been identified within the proposed Pit8C or Shaft 16 WRD expansion sites. Notwithstanding the above, any chance finds at the proposed project sites will require a permit from the South African Heritage Resources Agency (SAHRA) if these sites were to be altered.

1.3.3 SOCIO-ECONOMIC

Information in this section was sourced from the socio-economic review for Impala (Strategy4Good, June 2011) and the economic landuse and sustainability study included in Appendix F (Strategy4Good, September 2012).

Introduction and link to impact

The proposed projects have the potential to result in both positive and negative socio-economic impacts. The positive impacts are usually economic in nature with mines contributing directly towards employment, procurement, skills development and taxes on a local, regional and national scale. In addition, mines indirectly contribute to economic growth in the local and regional economies because the increase in the number of income earning people has a multiplying effect on the trade of other goods and services in other sectors.

While the proposed projects are small in scale when compared to the existing Impala operations, they can contribute to potential negative social impacts, either on their own or cumulatively in the context of the mine as a whole. In this regard, mines can cause an influx of people seeking job opportunities which can lead to increased pressure on basic infrastructure and services (housing, health, sanitation and education), informal settlement development, increased crime, introduction of diseases and disruption to the existing social structures within established communities; and

To understand the basis of these potential impacts, a baseline situational analysis is described below.

Data collection

Data was collected through the review of available databases and field observations.

Results

Local level – Bojanala District Municipality and Rustenburg Local Municipality

Population

The population residing within the Bojanala Platinum District Municipality (BPDM) constitutes approximately 39 % of the total population of the North West province. Rustenburg local municipality (RLM) is the largest municipality within the district, with a population concentration of approximately 32 % of the total population of BPDM. The average household size in BPDM is estimated to be with an average household size of 3.4, with RLM's average household size at 2.9.

Economic activity

Mining plays an important role in the region's economy and is the district's major source of employment. It was estimated that in 2009, 33% of the district's economically active population was employed in the mining sector. Fifty percent (50%) of RLM's economically active population was employed by this industry. As reflected at a provincial level, the sectors with the smallest contributions to the province's Gross Geographic Product (GGP) were Electricity and Water, along with Transportation, Agriculture and Construction – all within the range of a 2-4% contribution.

Unemployment

An unemployment rate of 25% and 20% has been estimated for 2009 at the district and local municipal levels respectively.

Education

In 2010, approximately 66% of the BPDM residents constituted the working age population. Of these individuals, 19% have completed matric and 7% have received no formal education in line with the South African schooling system. This is a similar depiction of the RLM, with 18% obtaining a matric certificate and 6% of the population with no schooling. Within the RLM, 71% of the population is of working age.

Basic Services

As far as access to piped water is concerned, BPDM and its RLM displays a similar profile to that of the province at large. Nine percent and 11% of the district and local municipality households', respectively, use alternate water sources. The remainder of each population has access to piped water. Higher than the provincial average, 56% of households with toilet facilities utilise pit or bucket latrines in BPDM. In RLM, pit or bucket latrines are used by 38% of households. As depicted at a provincial level, between 8 and 9 percent have no toilet facilities. Electricity is used as a primary source of energy for lighting in 87% of the homes within BPDM and 81% in RLM. Refuse removal services are provided to the majority of all households at the district and local municipal levels, with 11% not having any refuse disposal facilities.

Housing

It is estimated that 33% of the BPDM homes are informal dwellings. Approximately 38% of the RLM homes are informal dwellings, of which 20% are in informal settlements and 18% can be found in backyards.

HIV Status

A total of 14% within the BPDM have tested positive to HIV, with 15% testing positive in the RLM. Similar to the provincial level 1% of both the district and local municipalities' residents died of AIDS related illness.

Local level – Bafokeng nation and other communities surrounding the proposed project sites

With reference to the municipal demarcation board, communities as listed in Section 1.3.4 form part of the Bafokeng nation. This section therefore focus on socio-economic conditions on a local level for both the Bafokeng Nation which includes the communities surrounding the proposed project sites.

Population

The Bafokeng Nation has a relatively large population in the area, estimated at 155 342 (2009) and it is assumed that this growth rate corresponds to the rest of Rustenburg's growth rate of 2.2%. This translates to an estimated 150 people per square km, as opposed to the SA average of around 40 people per square km. This means that the local areas are highly populated. Estimated population numbers as of 2009, located within the surrounding communities as listed in Section 1.3.4 include: Freedom Park (7984), Lefaragatlhe/Bobuampja (9057), Luka South (13 058), Mogono (41560), Kanana (13589), Seretube (536) and Mafika (741).

In addition to this, there has been a tremendous influx of people into the Rustenburg Municipality and this is also evidenced in the Bafokeng area.

Economic Activity

As is to be expected, the mining sector accounts for the most jobs, being 58%. Places like Luka South and Mogono are almost entirely dependent on mining jobs – in effect these are in a form of mining villages and as such are vulnerable to mine closures. The tertiary sector (services and government), makes up 23% of the jobs within the Bafokeng areas. The percentage households on or below the poverty line is still high, and due to the increase in informal settlements as a result of in-migration, this proportion has steadily risen to 33% in 2009.

Employment/Unemployment

On average, the estimated unemployment rate was 23% in 2009. Similarly was the under-employment rate (people not looking for jobs), which amounts to 40%. With respect to the Bafokeng Nation only 37% (3.7 adults out of all adults), have formal jobs. Only 25% of the workforce is in elementary jobs, which is relatively little compared to other rural areas, which have as much as 50% of the workforce in elementary jobs. The unemployment rates and under-employment rates for the surrounding communities as listed in Section 1.3.4 as of 2009 are summarized in Table 28 below.

TABLE 28: UNEMPLOYMENT AND UNDER-EMPLOYMENT RATES OF SURROUNDING COMMUNITIES

Surrounding community	Unemployment rate (%)	Under-employment (%)
Freedom Park	31	22
Lefaragatlhe/Bobuampja	23	37
Luka South	24	31
Mogono	29	31
Kanana	27	28
Seretube	26	35
Mafika	31	23

With respect to the communities within and surrounding the Impala surface use area, Freedom Park and Mafika have the highest percentage of unemployed people, while Luka and Lefaragatlhe/Bobuampja have the lowest percentage of unemployed people. On average the estimated unemployment rate relative to the communities surrounding the propose project areas is 28% with 21% of the workforce in elementary jobs.

Education

Within the Bafokeng Nation the total amount of adults that have no schooling (illiterate or semi-illiterate) is still high at 25% even though this has improved marginally since 2001. The percentage of the population that had matriculated also increased marginally and stands at 25% as at 2009. The high level of illiteracy still makes the affected communities relatively un-educated.

The percentage of matriculates relative to the communities surrounding the proposed project areas include: Freedom Park (7%), Lefaragatlhe/Bobuampja (25%), Luka South (24%), Mogono (27%), Kanana

(19%), Seretube (37%) and Mafika (25%). This means that only 23% of the communities surrounding the proposed project sites have matriculated.

Basic Services

Within the Bafokeng Nation there has been a strong improvement in the electrification of houses (56% of the houses), but water piping into the dwelling (as opposed to the yard), is still inadequate (an estimate 8% area had water linked to dwellings). The number of dwellings where water was provided to the household yard was 42%. With regards to the communities surrounding the proposed project site, the percentage of electrification of houses, water piping is summarized below.

TABLE 29: ELECTRIFICATION AND WATER PIPING OF SURROUNDING COMMUNITIES

Surrounding community	House hold electrification (%)	Water piping to the dwelling (%)	Water piping to the yard (%)
Freedom Park	0	0	0
Lefaragatlhe/Bobuampja	37	6	67
Luka South	67	1	91
Mogono	75	0	95
Kanana	43	2	13
Seretube	89	0	33
Mafika	39	0	0

With regards to the communities within the surrounding project, all the communities have access to house hold electricity except Freedom Park. Only 1.2% of the surrounding communities consist of water piping into the dwelling with 43% of the communities having water provided to the yard. These results indicate that the larger communities that existed prior to the establishment of Impala are better off.

Most houses within the Bafokeng Nation and communities surrounding the proposed project areas have a pit latrine and very few had flush toilets. In addition to this on average, well over 90% of these communities have access to a form of telephone (mobile, landline or public).

Housing

In 2001 the Bafokeng Nation area had under 17 000 brick houses and just under 19 000 informal dwellings, which is a large ratio of informal to formal dwellings. Communities close to Impala, have 65% formal to only 25% informal dwellings. The percentage of brick housed within the communities surrounding the proposed project areas include: Freedom Park (1%), Luka South (59%), Kanana (44%), Lefaragatlhe/Bobuampja (38%), Mafika (94%), Mogono (80%) and Seretube (89%).

This indicates that people in mining communities are better off than those that are not. In addition communities that originated as a result of the mine such as Freedom Park are worse off than those communities that existed prior to the establishment of the mine.

Health and HIV Status

HIV/Aids statistics are unfortunately not available on a Ward level, but as previously indicated between 14% and 15% of the BPDM and RLM, respectively, have tested positive for HIV. Similar to the provincial level 1% of both the district and local municipalities. This is more than the country's average of 12%. Of the infected, 7.2% died of AIDS related illnesses. This number is also higher than the national average.

Conclusion

The municipal and local level descriptions indicate that in the communities surrounding Impala's operations, there are significant social and economic challenges. The existing situation indicates that there is a measure of unemployment, inward migration of people with the resultant pressure on basic infrastructure and services (health, education, sanitation, water etc.), informal settlement development, increased crime, introduction of diseases and disruption to the existing social structures within established communities. Whilst the proposed Pit8C and Shaft 16 WRD expansion projects may contribute (cumulatively) to the social and economic challenges described above, given the scale of the projects when compared to other Impala projects, it is expected that the associated negative socio-economic impact will be negligible.

In the context of the existing socio-economic situation and the proposed projects, the potential positive socio-economic impacts may include job extension as well as limited opportunity for job creation (new jobs will be created during the construction phase of the WRD expansion only).

1.3.4 LAND USES

Information provided in this section was sourced by SLR.

Introduction and link to impacts

Mining activities have the potential to affect land uses both within the proposed project areas and in the surrounding areas. This can be caused by physical land transformation and/or through direct or secondary impacts. The key related potential environmental impacts are: loss of soil, loss of land capability, loss of biodiversity, pollution of water, dewatering, air pollution, noise pollution, damage from blasting, visual impacts, loss of heritage resources, and the influx of job seekers with related social ills. To understand the basis of the potential land use impacts, a baseline situational analysis is described below.

Data Collection

Mining right and land ownership details were sourced from Impala. On-site and surrounding land use data was sourced from site observations and the review of topographical maps and satellite imagery.

Results – Mining rights in the Impala area

Impala's current mining rights and prospecting rights area is illustrated in Figure 13. The current mining rights were all executed on 12 December 2008.

Results – Mining rights in the proposed project areas

With reference Figure 13, the mining rights applicable to the various proposed projects are summarised in Table 30 below.

TABLE 30: MINING RIGHTS IN THE PROPOSED PROJECT SITES

Proposed project	Property description	Portion number	Mining rights
Pit8C	Vaalkop 275 JQ	Whole farm	Mining rights held by Impala – reference numbers NW30/5/1/2/2/131MR
	Beerfontein 263 JQ	Portion 2	Mining rights held by Impala – reference numbers NW30/5/1/2/2/133MR
Shaft 16 WRD expansion	Reinkoyalkskraal 278 JQ	Portion 3	Mining rights held by Impala - reference numbers NW30/5/1/2/2/131MR and 133MR

Results – land ownership in the proposed project areas

The surface use area is an area of land that Impala may utilise for mining activities subject to obtaining all necessary authorisations in terms of mining and environmental legislation. Impala does not own any portion of land in the surface use area. The surface use area is made up of surface right permit areas, notarial mineral mining lease areas between individuals and the state, and a mineral lease agreement with the RBA. The surface right owners and corresponding title deed numbers of the land in the project areas is listed in Table 31. Please note that only land ownership within Impala's surface use area has been mapped (Figure 13).

TABLE 31: LAND OWNERSHIP WITHIN THE PROPOSED PROJECT AREAS

Farm Name	Portion number	Title deed number	Surface owner as per title deeds search (July 2012)
Reinkoyalskraal 278 JQ	Portion 3	T373/1992BP	Bafokeng Tribe (RBA)
Vaalkop 275 JQ	Portion 0 (whole farm)	T4/1980BP	Magata's Tribe (RBA)
Beerfontein 263 JQ	Portion 2	T373/1883BP	Republic of Bophuthatswana (RBA)

In addition to the landowners, the land users (described below) are the only other parties that are expected to be directly affected by either of the projects.

Other parties that may be indirectly affected by the projects and that have been identified to date include:

- downstream water users; and
- surrounding communities.

Results – land claims

No land claims have been lodged on any of the farm portions within the proposed project areas (Appendix A).

Results - Land use within the proposed project areas

Land use within the proposed project areas is a mixture of agriculture and mining activities. More detail is provided below:

Agriculture

Basi Ntsimane currently has a lease agreement in place with the Royal Bafokeng for the utilisation of land for sunflower farming at the proposed Shaft 16 WRD expansion area whilst several members of the Royal Bafokeng Stock Farmer's Union have informal agreements in place with the Royal Bafokeng for the utilisation of a large area of land for ad-hoc grazing (which includes the small patch of vacant land on which the Pit8C site is located).

Community/suburban areas

There are no communities or community structures in the immediate vicinity of either project. It is also unlikely that communities or community structures will be directly affected by the projects. For the sake of completeness, the closest communities are as follows:

- the closest community to the Pit8C project site is Luka South which is approximately 1.75 km north-west of the site; and
- the closest community to the Shaft 16 WRD expansion site is Kanana which is approximately 600 m north-east of the site. In this regard it must be noted that the current WRD is situated between the closest section of Kanana and the proposed expansion site.

Infrastructure and servitudes

Impala has an extensive network of roads, railways, pipelines, power lines and telephone lines (Refer to Figure 2). Some of these structures are located within or adjacent to both project sites because these sites are located within Impala's existing surface use area. Further detail is provided below.

Infrastructure and servitudes within the proposed Pit8C project area are:

- a buried 110 mm water pipeline as well as numberous other water pipelines traverse the proposed Pit8C project area;
- a 24 corefibre optic cables traverses the proposed Pit8C project site; and
- numerous stores, a cable yard, a storage yard, and a cement yard are located within the proposed opencast area.

No infrastructure and servitudes are located within the Shaft 16 WRD expansion footprint area.

Servitudes are registered rights for certain infrastructure and activities (eg. pipelines, power lines, roads, railway lines) that restrict other current and/or future land uses in so far as these land uses interfere with the servitudes. While there is Impala infrastructure (particularly at the Pit8C site) that will have to be diverted or moved, all the third party infrastructure and related servtudes are outside of the footprint of both sites.

Result - Land use surrounding the proposed project areas

Land use surrounding the proposed project areas is a mixture of agriculture and mining with small portions of wilderness. More detail is provided below:

Agriculture

Agricultural activities currently undertaken surrounding the proposed project areas include fire wood harvesting, crop harvesting (this includes dryland sunflowers and maize), and livestock grazing. Any crop cultivation is limited to areas that have not been occupied by mining related infrastructure and surrounding communities. Farmers in the area rely on rain to water their crops and may commonly experience losses because the summer rains are late or insufficient.

Communities/suburban

There are a number of communities in the vicinity of the proposed projects. The closest of these are listed below:

- Luka South (approximately 1.5 km north-west of the Pit8C site)
- Kanana (approximately 600 m north-east of the Shaft 16 WRD expansion site)

The larger communities have many residential buildings, multiple schools, shops, sports facilities and supporting infrastructure. Smaller communities have similar types of amenities and facilities but on a smaller scale.

While not relevant to the Shaft 16 WRD expansion, previous crack surveys done by Partridge, Maud Associates (Partridge, Maud, March 2006) for opencast mining in general indicated that some of the observed cracked houses were as a result of poor building practices, poor drainage and/or the expansive

properties of clay on which building foundations were placed. Notwithstanding the above, in certain circumstances blasting has the potential to cause damage to buildings and/or exacerbate pre-existing conditions.

Infrastructure and servitudes

As indicated above, Impala has an extensive network of roads, railway, pipelines, power lines and telephone lines (Refer to Figure 2). Some of this existing Impala infrastructure and servitudes are located within close proximity to the proposed project sites. Further detail is provided below.

The surrounding infrastructure and servitudes in the vicinity of the proposed Pit8C site are:

- a regional 88Kv overhead Eskom power line situated approximately 120 m to the south of the site;
- a 240Kv power cable is located approximately 200 m south-west of the site;
- Impala stores and offices are located directly adjacent to the north-east and west of the site. These offices and stores comprise various buildings and infrastructure such as car ports, garages, a workshop, boiler room, guard house, training centre, and numerous buried water pipelines;
- the Rand Water pipline (110 mm) is located approximately 100 m to the south of the site;
- internal Impala railway lines (including railway core fibre obtic cables) are located approximately 50m to the south of the site; and
- internal Impala roads are located directly adjacent to the sourthern and eastern side of the site. Various other internal Impala roads are located approximtaley 110 m and 220 m to the west of the site.

The surrounding infrastructure and servitudes in the vicinity of the proposed Shaft 16 WRD expansion site are:

- the regional Z523 road is situated approximately 500 m to the north-east of the site; and
- Impala's internal railway line which runs approximately 100 m to the south and west of the site.

Conclusion

It is not expected that either of the projects will interfere with third party infrastructure and servitudes.

Whilst the Shaft 16 WRD is located within close proximity to Kanana, given the nature of the project it is not anticipated that community and suburban area activities will be affected by the development thereof. In addition to this it should be noted that the expanded WRD will be further from Kanana than the current WRD. In the case of Pit8C no communities are in close proximity to the proposed site.

Given the temporary nature of the Pit8C project, the grazing potential will be returned as close as possible to its pre-disturbed state following closure and rehabilitation. The Shaft 16 WRD expansion will however remain in perpetuity and therefore the dryland sunflower cultivation and grazing potential of the proposed site will be irreversibly lost.

1.4 MAPS SHOWING THE SPATIAL LOCALITY AND AERIAL EXTENT OF ENVIRONMENTAL FEATURES

This section includes a series of maps that show the spatial locality and aerial extent of all environmental, cultural/heritage, infrastructure and land use features identified on site and on the neighbouring properties and farms. These maps include:

- Geology (Figure 3);
- Geological succession (Figure 4);
- Period average wind roses (Figure 5);
- Soil forms within the proposed project areas (Figure 6);
- Land capability within the proposed project areas (Figure 7);
- Vegetation types (Figure 8);
- Vegetation communities (Figure 9);
- High biodiversity areas (Figure 10)
- Hydrological catchments (Figure 11);
- Floodlines (Figure 12);
- Converted mining rights areas (Figure 13).

In addition, photographs taken from eight major compass directions are provided in Figure 14 and Figure 15.

FIGURE 3: GEOLOGICAL SUCCESSION

FIGURE 4: GEOLOGICAL FEATURES

FIGURE 5: PERIOD AVERAGE WIND ROSES

FIGURE 6: SOIL FORMS WITHIN THE PROPOSED PROJECT AREAS

FIGURE 7: LAND CAPABILITY WITHIN THE PROPOSED PROJECT AREAS

FIGURE 8: VEGETATION TYPES

FIGURE 9: VEGETATION COMMUNITIES

FIGURE 10: HIGH BIODIVERSITY AREAS

FIGURE 11: HYDROLOGICAL CATCHMENTS

FIGURE 12: FLOODLINES

FIGURE 13: CONVERTED MINING RIGHTS AREA

FIGURE 14: SITE PHOTOGRAPHS TAKEN IN 8 MAJOR COMPASS DIRECTIONS (PIT8C)

FIGURE 15: SITE PHOTOS TAKEN IN 8 MAJOR COMPASS DIRECTIONS (SHAFT 16 WRD EXPANSION SITE)

2 PROPOSED OPENCAST MINING AND WRD EXPANSION PROJECTS

The information in this section was provided to SLR by the Impala project team.

Impala is proposing the development of the following projects:

- the proposed Pit8C opencast pit; and
- the proposed expansion of the WRD at Shaft 16.

In order to provide context to the proposed project, specific data has been provided below.

Proposed Pit8C project

Project specific data that provides perspective on the scale of the proposed new Pit8C is provided in Table 32 below. Refer to section 2.7 for additional information.

TABLE 32: PROJECT DATA THAT PROVIDES PERSPECTIVE ON THE SCALE OF THE PROPOSED NEW PIT8C

Features	Detail
Total in situ tonnage	105 000 tons
Target ore body	Merensky Reef
Depth of pit	30 m
Total area of pit	4.8 ha
Operating hours	24 hours/day (except Sundays)

Shaft 16 WRD expansion

Project specific data that provides perspective n the scale of the proposed WRD expansion is provided in Table 33 below. Refer to section 2.7 for additional information.

TABLE 33: PROJECT DATA THAT PROVIDES PERSPECTIVE ON THE SCALE OF THE PROPOSED WRD EXPANSION.

Features	Detail
Size of WRD expansion	Approximately 19.7 ha
Height of WRD expansion	Approximately 40 m
Capacity	Approximately 3 868 852 m^3
Operating hours	24 hours/day (except Sundays)

2.1 MINERAL TO BE MINED

The converted mining rights and minerals to be mined relevant to the proposed Pit8C project are outlined below:

NW30/1/2/2/131 MR:

The notarial executed converted mining right covers: Platinum Group Metals, Nickel Ore, Gold Ore, Cobalt, Chrome Ore, Silver Ore, Copper Ore, Sulphur, Sand (manufactured) from waste rocks and Iron Ore.

NW30/1/2/2/133 MR:

The notarial executed converted mining right covers: Platinum Group Metals, Nickel Ore, Gold Ore, Silver Ore, Cobalt, Copper Ore, Sulphur, Sand (manufactured) from waste rock and Iron Ore. The section 102 application to include Chrome Ore was approved by DMR

2.2 MINING METHOD TO BE EMPLOYED

2.2.1 PROPOSED PIT8C PROJECT

The proposed opencast operations will target only the Merensky reef. This is described in further detail below.

Site preparation

Site preparation for the Pit8C area will include the clearing of vegetation.

Earthworks

Following site preparation all topsoil and some overburden/waste rock will be dozed and temporarily stockpiled separately for re-use during pit backfilling and rehabilitation.

The temporary topsoil stockpile associated with Pit8C will cover an area of approximately 1.5 ha.

Drilling and blasting

Once the topsoil and some of the overburden/waste rock has been removed by dozing, blasting and drilling methods will be used to loosen the remaining waste rock/overburden and ore. The reef dips at 13 degrees and therefore the associated boxcut design at Pit8C is 210 m long, 100 m wide and 35 m deep. A 10 m boundary pillar is left between the existing underground and opencast mining operations.

Blasting activities associated with the proposed Pit8C project will take place during the week for the duration of the project.

Removal of overburden/waste rock

Truck and shovel methods will be used to load and haul the overburden/waste rock to the designated temporary stockpile area. The temporary waste rock/overburden stockpile area will cover approximately 1.5 ha with an estimated 720 000 m^3 of waste rock being removed and replaced in the life of the project.

Removal of run-of-mine

The run-of-mine (ROM) will be loaded and hauled using truck and shovel methods and will be transported off-site for crushing.

Crushing

The ROM will be transported to an existing crusher prior to being sent to the relevant Impala concentrator.

Rehabilitation

Rehabilitation is concurrent with the mining operations. Overburden/waste rock will be used to backfill the pit. Topsoil will be placed on the top of the overburden/waste rock. The surface profile of the backfilled pit will be domed in order to account for the bulking factor and post rehabilitation settling. Vegetation will be allowed to re-establish itself on the backfilled areas.

Given that the Shaft 16 WRD expansion does not involve any extraction of mineral resources, no mining method will be employed.

2.3 LIST OF MAIN ACTIONS/ACTIVITIES/PROCESSES

Key activities that will take place on site during each phase (construction, operational, decommissioning, closure) of the project are listed in Table 34 below. This table reflects the chosen preferred alternative. Alternatives considered in the development of the proposed project plan are discussed in Section 2.8.

TABLE 34: LIST OF PROJECT ACTIONS / ACTIVITIES / PROCESSES

Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
Site preparation	Bush clearing in line with Impala's biodiversity management plan	On-going	As required	As required	
	Removal of existing structures (if present).	On-going	As required	As required	
	Establishing the construction contractor's area	At start of phase	As required	As required	
Earthworks	Vehicle maintenance, wash bays, storage of fuel and lubricants	On-going	As required	As required	
	Stripping and stockpiling of soil resources in line with Impala's soil management programme	On-going	As required	As required	
	Cleaning, grubbing and bulldozing activities	On-going	As required	As required	
	Removal of building rubble	On-going	As required	As required	
	Establishing gravel roads	On-going	As required	As required	
	Digging trenches and foundations. Possible blasting	On-going	As required	As required	
	Developing and management of borrow pits (backfilling of material from borrow pits)	On-going	As required	As required	
	Establishing storm water controls (channels, berms) as per storm water management plan	At start of phase	As required	As required	
Civil works Civil works on site relate mainly to any steel and concrete work.	General building activities and erection of structures	On-going	As required	As required	
	Foundation excavations and compaction	On-going	As required	As required	
	Use of scaffolding and cranes	On-going	As required	As required	
	Erection and destruction of scaffolding	On-going	As required	As required	
	Mixing of concrete and concrete work including silos, culverts and plinths	On-going	As required	As required	
	Steel work (including grinding and welding)	On-going	As required	As required	
	Vehicle maintenance and wash bays	On-going	As required	As required	
	Storage and handling of: fuel, lubricants, sand, rock, cement, chemical additives in cements	On-going	As required	As required	
	Installing re-enforcement steel	On-going	As required	As required	
Prospecting and survey activities (drilling, reconnaissance and seismic survey)	Drilling using truck-mounted, diesel powered core-recovering drilling machines.	On-going	On-going	On-going	
	Seismic survey using trucks equipped with hydraulically-operated vibrating plates	As required	As required	As required	
	Site support services include: - Stores for fuel and lubricants	On-going	On-going	On-going	

Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
	- stores for core trays - On-site offices (pre-fabricated structures) - Portable toilets - Water tankers - Sumps and pipes - Sludge - Vehicle maintenance and wash bays - Temporary accommodation if required (caravans and tents on site)				
Shafts	Water management facilities include: - Diversion of clean water - Separation of dirty water and clean water - Collection of dirty water using pollution control dams for recycling and re-use	On-going	On-going	On-going	
	Waste rock dumps: stockpiled, crushed by third parties for third party use, and/or re-processed at concentrator plants	On-going	On-going	On-going	Some will be permanent
	Construction and utilisation site support services include: - Workshop equipped with washbays - Office complex - Change house and ablution facilities - Underground sewage collection area for discharge to conservancy tank with sewage pump station, conservancy tank which is emptied by honeysucker or directly into sewer lines - Silos - Diesel storage tanks (re-fuelling of equipment) - Wash bays - Parking area and bus terminal - Explosive depot and used packaging burning bay and disposal area - Explosives magazine for sinking shafts - Stores - Storage area for hazardous and non-hazardous input materials and waste	On-going	On-going		

Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
	- ROM stockpiles - Canteens - Clinic - Burning bays				
Opencast mining	Drilling and blasting	At start of phase (open the pit)	On-going		
	Removal of overburden by dozing and load and haul	On-going	On-going		
	Stockpiling of overburden for backfilling, crushed by third parties for third party use, and/or re-processed at concentrator plants	On-going	On-going		
	Excavation of sample trenches	At start of phase			
	Removal of ore by dump trucks and/or trains and transported to the crushers/concentrator plant		On-going		
	Use of mobile crushers to size the ROM		On-going		
	Water management facilities include: - collection of dirty run-off water in settling facilities and re-used - clean run-off and drainage sheet flow will be diverted around dirty areas	On-going	On-going	On-going	
	Construction and utilisation of site supporting services: - access control and security - contractors yard - canteens - workshops - stores - wash bays - storage area for hazardous and non-hazardous waste - portable toilets at digging sites and open cast pits - formal ablution facilities within contractor yard - diesel tanks and or diesel bowsers (re-fuelling equipment) - ROM stockpiles	On-going	On-going	On-going	
	Dewatering of the open pit and storage for re-use in		As required		

Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
	the storage dams				
	Cessation of dewatering activities			Occasionally if required	
	Waste rock dumps: crushed by third parties for use and backfilling of open cast pits		On-going	On-going	
	Delivery of ROM from incoming rail and or truck and transferred to conveyors and stored in silos		On-going		
Power and compressed air supply and use	Construction, operation and maintenance of electricity lines, compressors and compressed air pipe lines	On-going	On-going	On-going	
	Construction, operation and maintenance of substations and transformers	On-going	On-going	On-going	
	Workshops				
	Installation of lighting plants (typically used for lighting up open pit areas)		On-going		
	Mobile diesel powered generators (typically used by on-site open cast operations prospecting and contractors at sinking shafts)	On-going	On-going	On-going	
	Power line diversions	At start of phase, where required			
Water supply and use	Construction, operation and maintenance of pipelines for water supply	On-going	On-going		
	Sourcing water from the Impala water circuit (includes domestic and process water)	On-going	On-going		
	Potable water supplied by Rand Water and Magalies Water (external water supply stored in a reservoir and distributed via a network of pipelines) and boreholes at Shaft 16.	On-going	On-going	On-going	
	Recycling and re-use via pipelines from the following sources: - Sewage treatment plants; - Tailings return water system; - Process water dams - Storm water control dams - Shaft ingress water - Sludge dams and water control dams at shafts	On-going	On-going	On-going	

Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
	- Water holding facilities at open cast mining area - Rockwall dam (originally used as pollution containment facility, then as a return water dam, and now the intention is to utilise it as a clean water storage and abstraction dam) - Effluent water sourced externally to be used as make up water				
	Pipeline diversions	On-going	On-going	On-going	
Transport systems	Construction, operation and maintenance of railway lines	On-going	On-going	On-going	
	Construction, operation and maintenance of gravel and tar roads	On-going	On-going	On-going	
	Vehicle, loco's, hopper, train and equipment servicing and maintenance workshops, spray painting and wash bays.	On-going	On-going	On-going	
	Installation and use of parking, loading and off-loading areas for trucks, buses and other vehicles	On-going	On-going	On-going	
	Transportation of staff to and from site (using buses and private cars via surfaced and gravel roads)	On-going	On-going	On-going	
	Transport of input materials, supplies, services, sewage and waste removal (using trucks and vans via surfaced and gravel roads)	On-going	On-going	On-going	Limited
	Transportation of ROM, soil and waste rock via trucks/conveyors		On-going	On-going	Limited
	Transportation of ROM via rail and trucks		On-going		
	Transport of PGM and Chrome products via trucks		On-going		
Non-mineralised waste management (general and industrial hazardous)	Handling, storage and disposal of general waste on site: - Domestic waste - Uncontaminated PPE - Garden waste - Food waste - Building rubble - Paper - Plastics - Glass	On-going	On-going	On-going	

Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
	- Metals - Rubber - Wood				
	Handling, storage and disposal of hazardous waste on site: - Batteries - Waste oils - Organic compounds and solvents (reagents, chemicals etc) - WEEE waste (electrical and electronic equipment, cartridges etc) - Health care risk waste (clinics and hospital waste) - Sewage sludge (sewage plants) - Explosives waste - Contaminated metals, platic, rubber and wood	On-going	On-going	On-going	
	Separation of oil and water at wash bays	On-going	On-going	On-going	Limited
	Disposal and/or treatment of contaminated soils	On-going	On-going	On-going	
	Temporary storage of and hazardous waste within dedicated demarcated containers/areas	On-going	On-going	On-going	
	Sorting of general and hazardous waste for re-use and/or recycling purposes	On-going	On-going	On-going	
	Removal of waste by contractor for recycling, re-use and/or final disposal at permitted waste disposal facilities	On-going	On-going	On-going	

Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
	Treatment of sewage sludge at Impala sewage treatment facility (Impala currently has three sewage treatment plants that make use of the activated sewage treatment method. The treated sludge is used as input into the rehabilitation woodchips project. The treated effluent is returned to the process water circuit).		On-going	On-going	
General site management	Appointment of contractors and establishment of contractor working camps and areas where this is not done by Impala	On-going	On-going	On-going	On-going
	Site management (monitoring, inspections, maintenance, security, access control)	On-going	On-going	On-going	On-going
	Environmental awareness training and emergency response	On-going	On-going	On-going	On-going
	On-going rehabilitation of facilities/disturbed areas (where possible)	On-going	On-going	On-going	On-going
	Implementing and maintaining management plans	On-going	On-going	On-going	On-going
Other support services and amenities	On-site first aid facilities, occupational health bureau, clinics and hospital for Impala employees and contractors	On-going	On-going	On-going	
	Canteens	On-going	On-going	On-going	
	Main and satellite procurement stores with bulk storage of fuel, lubricants and chemicals	On-going	On-going	On-going	
	various office and administration areas	On-going	On-going	On-going	
Demolition	Removing construction contractor's area (if not incorporated into plant footprint)	At end of phase		At end of phase	
	Dismantling and demolition of infrastructure and equipment. Possible blasting		For maintenance	On-going	
	Utilisation of site supporting services: - access control and security - contractors yard - canteens - workshops and wash bays - general stores - storage area for hazardous and non-hazardous waste		For maintenance	On-going	

Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
	- portable toilets at digging sites and open cast pits - formal ablution facilities within contractor yard - diesel tanks and or diesel bowsers (re-fuelling equipment)				
Rehabilitation	Backfill and rehabilitating of all pits and voids with provision for preventing surface subsidence	On-going	On-going	On-going	As required
	Backfilling of prospecting borehole sumps with topsoil	On-going	On-going	On-going	As required
	Prospecting borehole sealing	On-going	On-going	On-going	As required
	Underground supports and shaft sealing	On-going	On-going	On-going	As required
	Replacing soil resources	On-going	On-going	On-going	As required
	Slope stabilisation and erosion control	On-going	On-going	On-going	As required
	Landscaping	On-going	On-going	On-going	As required
	Re-vegetation of disturbed areas and where infrastructure was removed	On-going	On-going	On-going	As required
	Removal of alien invasive species from rehabilitated sites	On-going	On-going	On-going	As required
	Restoration of natural drainage patterns as far as practically possible	On-going	On-going	On-going	As required
	Rehabilitation of all mineralised waste facilities and other stockpiles(tailings, waste rock, chrome, slag, sludge)	On-going	On-going	On-going	As required
	Rehabilitation of access roads	On-going	On-going	On-going	As required
	Remedeiation of groundwater		On-going	On-going	On-going
Maintenance and aftercare	Initiation of aftercare and maintenance program			At end of phase	
	Maintenance and repair of post closure landforms, facilities, and rehabilitated areas				On-going

2.4 PLAN SHOWING LOCATION AND EXTENT OF OPERATIONS

A site layout illustrating the full extent of the Impala overall operation including the proposed projects is provided in Figure 2. A zoomed in plan of the proposed Pit8C project is provided in Figure 16 and a zoomed in plan of the infrastructure layout for the proposed Shaft 16 WRD expansion project is illustrated in Figure 17.

2.4.1 PIT8C PROJECT

The proposed Pit8C project will require the establishment of the following infrastructure (Figure 16)

- temporary waste rock stockpile areas;
- temporary topsoil stockpile areas;
- new temporary gravel access and haul road;
- access control;
- stormwater diversion berms;
- de-watering collection dams – if required; and
- alternative development area for demolished Impala stores area.

2.4.2 SHAFT 16 WRD EXPANSION

Given that the proposed Shaft 16 WRD project is an expansion of the existing WRD, existing infrastructure will be used. This includes (Figure 17):

- contractors lay down areas;
- workshops, stores, wash bays, lay-down areas, fuel handling and storage area, offices, ablution facilities such as chemical toilets or septic tanks;
- handling and storage area for construction materials (paints, solvents, oils, grease) and waste;
- temporary stockpiles;
- water management infrastructure;
- explosives magazines;
- run of mine (ROM) pads;
- haul roads;
- access roads;
- power lines and water pipelines;
- ventilation infrastructure including fans;
- portable air compressors for sinking operations;
- settling ponds for sinking operations;
- conveyor; and

FIGURE 16: INFRASTRUCTURE LAYOUT OF THE PROPOSED PIT8C PROJECT

FIGURE 17: INFRASTRUCTURE LAYOUT OF THE PROPOSED SHAFT 16 WRD EXPANSION PROJECT

2.5 LISTED ACTIVITIES IN TERMS OF NEMA EIA REGULATIONS

The relevant NEMA listed activities that require authorisation are included in Table 35 below. As discussed in the introductory section of this report, a separate basic assessment report will be submitted in order to cater for the authorisation of the relevant listed activities.

TABLE 35: RELEVANT NEMA ACTIVITIES CURRENTLY BEING APPLIED FOR

Activity Number	Listed Activity in terms of Regulation 544, Listing Notice 1, 18 June 2010	Description of activity
23	The transformation of undeveloped, vacant or derelict land to- (ii) residential, retail, commercial, recreational, industrial or institutional use, outside an urban area and where the total area to be transformed is bigger than 1 hectare but less that 20 hectares; - Except where such transformation takes place for linear activities.	Both projects have a footprint of greater than 1 ha but less than 20 ha and are located in part on vacant land.
28	The expansion of existing facilities for any process or activity where such expansion will result in the need for a new, or amendment of, an existing permit or license in terms of the national or provincial legislation governing the release of emissions or pollution, excluding where the facility, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 0f 2008) in which case that Act will apply.	The Shaft 16 WRD expansion will require an amendment of Impala's water license.
Listed Activity in terms of Regulation 546, Listing Notice 3, 18 June 2010		
12	The clearance of an area of 300 square metres or more of vegetation where 75 % or more of the vegetation cover constitutes indigenous vegetation. - (a) Within any critically endangered or endangered ecosystem listed in terms of Section 52 of NEMA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004	Part of the Pit8C site is located on vacant veld which falls within the Marikana Thornveld, a vegetation community which according to NEMBA is considered a key biodiversity area in need of protection. It is unclear whether the specific project area falls within the NEMA protection areas, so this activity has been included for the sake of completeness as discussed with DEDECT.

2.6 INDICATION OF PHASES AND TIMEFRAMES ASSOCIATED WITH THE MAIN ACTIONS/ ACTIVITIES/ PROCESSES

Proposed project timelines are detailed in the table below. If the decisions for the project are positive, construction activities will be undertaken at the start of each of the project phases identified above.

Aspect	Timeframe
Pit8C	

Start construction	Construction will commence in 2013 subject to authorisation (from authorities and the Impala board)
Duration of construction phase	Approximately 3- 5 months (opening of boxcut)
Life of operation	Approximately 12-18 months
Shaft 16 WRD expansion	
Start construction	Construction will commence in 2013 subject to authorisation
Life of operation	Approximately 30 years

2.7 ADDITIONAL INFORMATION

This section provides additional technical information relative to the construction, operation, decommissioning and closure phases for the proposed projects.

2.7.1 CONSTRUCTION PHASE

An overview of construction activities is provided in Section 2.3. Further detail where required is provided in the sections below.

Contractor facilities

None of the proposed projects will require the establishment of contractor facilities as existing contractor facilities will be utilised and as such no new wash bays, workshops, administrative buildings, change houses, designated waste disposal areas, stores, parking areas and housing will be established.

Stormwater control for construction

Storm water measures outlined in Section 2.7.2 will be established for both projects at the start of the respective construction phase.

Employment for construction phase

Pit8C

Given that existing workers will be used, no additional workers will be employed in the Pit8C project at any stage.

Shaft 16 WRD expansion

Construction phase employment for the WRD expansion will involve people from the local community where possible. It is estimated that approximately 10-20 workers will be sourced from the local community.

Transportation (routes and mechanisms) for construction

Access to Pit8C

Access to the proposed Pit8C project site will be via a new temporary gravel access road. This access road will be contructed form in situ material ripped and compacted. The road will be approximately 2.2 km long with a maximum width of 4 m.

Access to the Shaft 16 WRD expansion

Given that access will be via existing gravel roads that currently form part of Impala's road network no new access roads will be constructed.

Transportation of workers and supplies

During the construction of the proposed projects there will be workers travelling to and from site, vehicles supplying input materials and machinery, and vehicles removing waste material. Table 36 below provides a conceptual indication of the increase in traffic associated with the construction phase.

TABLE 36: CONSTRUCTION PHASE TRAFFIC: MATERIALS AND STAFF

Item	Trips per day	Transportation routes
Pit8C		
Construction materials and non-mineralised waste removal transported by trucks	One truck a day (Two trips per day)	Traffic from outside Impala will access the site from the R510 and/or the R565. Traffic from within Impala will use the internal network of private roads
Existing pit employees relocated to new areas.	No additional trips	
Shaft 16 WRD expansion		
Construction materials and non-mineralised waste removal transported by trucks	One truck a day (Two trips per day)	
Construction employees	One bus per day (Two trips per day)	

Pipelines

Pipelines for the proposed Pit8C project

No permanent pipelines will be constructed. Experience from nearby opencast pits is that no dewatering is required however, a temporary mobile HDPE water pipeline may be required for abstracting any pit water that will then be used either for dust suppression on the gravel roads and/or process water at the concentrator plant.

Pipelines for the proposed Shaft 16 WRD expansion

Given that potable water will be transported in by bowser, no pipelines will be required.

Water supply and use for construction

Water during construction is needed for:

- dust suppression;

- drinking and sanitation for workers; and
- material mixing (eg. Cement).

Water will be obtained from the existing Impala water network by means of temporary moveable HDPE pipelines and/or water bowsers.

Power supply for construction

Pit8C

Power for the proposed opencast project will be sourced from 4.2 Kw mobile diesel generators.

Shaft 16 WRD expansion

Power for the Shaft 16 WRD expansion will be sourced from Shaft 16.

Non-mineralised waste management for construction

General and hazardous waste

The types of non-mineralised wastes associated with the proposed Pit8C project that could be generated during the construction phase include:

- general waste such as domestic waste, building rubble and cleared vegetation; and
- hazardous wastes such as fuel, lubricants and explosive packaging.

The types of non-mineralised wastes associated with the proposed Shaft 16 WRD project that could be generated during the construction phase include:

- general waste such as domestic waste and cleared vegetation and building material.

No general and hazardous waste will be stored on site during the construction phase of the proposed projects. General and hazardous waste will be collected and removed from the proposed project sites and transported to existing Impala waste management facilities where it will be temporarily stored prior to re-use, recycling, or disposal in accordance with existing approved practices.

Sewage

Portable toilets will be provided at the proposed Pit8C project site during the contruction phase. Routine sewage removal will be required to transport sewage from these portable toilets to one of the existing approved Impala sewage treatment plants. Existing Shaft 16 sewage facilities will be used to cater for the WRD expansion during the construction phase.

2.7.2 OPERATIONAL PHASE

An overview of operational activities is provided in Section 2.3. Further detail where required is provided in the sections below.

Employment

Pit8C

Given that existing contract workers will be used, no additional workers will be employed in the Pit8C project at any stage.

Shaft 16 WRD expansion

Once the expanded section of the Shaft 16 WRD is operational, no additional workers will be employed. Additional workers will only be required during the construction phase, in which approximately 10-20 workers will be sourced from the local community.

Transportation (routes and mechanisms) for operational phase

Access will be by means of the routes and mechanisms described under the construction phase in Section 2.7.1.

Transportation of workers and supplies

Table 37 below provides a conceptual indication of the traffic associated with the operational phase.

TABLE 37: OPERATIONAL PHASE TRAFFIC: MATERIALS AND STAFF

Item	Trips per day	Transportation routes
Pit8C		
Existing ROM vehicle transportation relocated to new areas.	No additional trips	Traffic from outside Impala will access the site from the R510 and/or the R565. Traffic from within Impala will use the internal network of private roads
Existing open pit employees relocated to new areas.	No additional trips	
Shaft 16 WRD expansion		
During the operational phase, the delivery of waste rock will be by conveyor and therefore an insignificant amount of road transport will be required.		

Pipelines

Operational pipelines are the same as those described under the construction phase in Section 2.7.1.

Non-mineralised waste management for operation

General and hazardous waste

The types of non-mineralised wastes associated with the proposed Pit8C project that could be generated during the operational phase include:

- general waste such as domestic waste and cleared vegetation; and

- hazardous wastes such as fuel, used lubricants and explosive packaging.

The types of non-mineralised wastes associated with the proposed Shaft 16 WRD project that could be generated during the operational phase include:

- general waste such as domestic waste and cleared vegetation and building material.

No general and hazardous waste will be stored on site during the operational phase of the proposed projects. General and hazardous waste will be collected and removed from the proposed project sites and transported to existing Impala waste management facilities were it will be temporarily stored prior to re-use, recycling, or disposal in accordance with existing approved practices.

Mineralised waste management for the operational phase

In compliance with Section 73 of Regulation 527, the design features associated with the temporary Pit8C WRD stockpile and permanent Shaft 16 WRD expansion are outlined in Table 38 below.

TABLE 38: DESIGN FEATURES FOR WASTE ROCK DUMP EXPANSION

Feature	Detail for Shaft 16 permanent WRD expansion	Detail for Pit8C temporary WRD stockpile
Physical Dimensions	Foot print area - approximately 19.7 ha Height - approximately 40 m.	Foot print area - approximately 1 ha Height - approximately 30 m
Physical Characteristics	Particle size will vary from chunks of rock to finer material. The water content of the materials will vary from 5 to 20%. The void ratio will vary from 0.5 to 1.0.	Particle size will vary from chunks of rock to finer material. The water content of the materials will vary from 5 to 20%. The void ratio will vary from 0.5 to 1.0
Chemical Characteristics	From an acid generating perspective the waste rock material is considered to have sufficient neutralizing potential and is therefore regarded as non-acid generating. Neutral pH leachate analysis indicated the potential for elevated concentrations of Iron and Nitrates. Groundwater monitoring results in close proximity to the Shaft 16 WRD also indicates that waste rock has the potential to contribute elevated concentrations of the following: Electrical Conductivity, Chloride, Sulphates, TDS, Calcium and Magnesium. Whether this is attributable to the rock itself or other factors in the mining and extraction process that could contaminate the rock has not yet been determined.	In its natural form the polluting potential of the materials is expected to be significantly less than that of the tailings. From an acid generating perspective the waste rock material is considered to have sufficient neutralizing potential and is therefore regarded as non-acid generating. Neutral pH leachate analysis indicated the potential for elevated concentrations of Iron and Nitrates. As has been identitifed at the existing Shaft 16 WRD, other factors may influence the contamination potential of waste rock. This may or may not apply to temporary waste rock from opencast mining which is different in nature to underground mining.
Transport and placement	All material will be transported by a conveyor system onto the expanded section of the Shaft 16 WRD.	Material associated with the proposed Pit8C project will be loaded onto trucks and transported to the temporary waste rock stockpile area.
Stormwater management	Stormwater trenches / berms around the upstream boundaries of the WRD that direct clean stormwater run-off around and away from the WRD.	Stormwater trenches / berms around the upstream boundaries of the waste rock dumps that direct clean stormwater run-off around and away

Feature	Detail for Shaft 16 permanent WRD expansion	Detail for Pit8C temporary WRD stockpile
		from the waste rock dumps.
Lining	Prior to commencement of dumping on the expanded section of the WRD, the topsoil will be stripped off the area of the footprint and stockpiled for subsequent re-use in rehabilitation of the dump. The underlying black turf will then be moisture conditioned and compacted to provide a liner under the WRD. Immediately after compaction, a protective layer of suitable material will be placed over the prepared layer to maintain moisture content and prevent desiccation. Waste rock will then be dumped over this protective cover.	Given the temporary nature of the stockpiles no lining will be provided. The in-situ clay types soils will not be stripped and are expected to contribute to seepage control.
Side slopes	In order for concurrent rehabilitation to be successful, flatter WRD side slopes are required (no steeper than 1 vertical:3 horizontal.). This is a significant change from the old method of dumping at the angle of repose and only flattening the sides at the end of the operational phase during site rehabilitation.	The side slope will be at the angle of repose.
Seepage and runoff collection	As an added measure, the lining system will be linked to a system of seepage and runoff collection trenches. Collected seepage and runoff will either be re-used in the Impala circuit or evaporated.	Given the temporary nature of the stockpiles no seepage collection will be provided.
Access and Access control	Existing access roads will be used for access to the Shaft 16 WRD. The existing perimeter fence will be extended to provide access control to the proposed Shaft 16 WRD expansion site.	A new temporary access road will be used to access the proposed Pit8C site WRD. A new perimeter fence will be contructed to provide access control to the proposed Pit8C WRD site.
Waste Minimisation	Some waste rock associated with the Shaft 16 WRD may be crushed by third parties?	In terms of the proposed Pit8C project, waste rock will be used for on-going rehabilitation and final closure of the pits
Dust control	No dust control will be provided at the WRD because these are not seen as a significant dust emissions source given the particle size distribution.	Haul roads will be watered for dust suppression. No dust control will be provided at the waste rock dumps because these are not seen as a significant dust emissions source given the particle size distribution
Life of facility	The operational life is controlled by the waste rock production rate. In the best case scenario, the facility may have a life of up to 30 years. If the facility is not re-processed it could remain in perpetuity.	The operational life is approximately 12 months.
Closure	There will be concurrent rehabilitation of side slopes as the dump progresses. Maintenance and aftercare will be undertaken to ensure that rehabilitation is successful. Although the WRD will be a permanent feature, it will be rehabilitated to a functional biodiversity landscape.	All the stockpile material will have been replaced in the opencast pit.

Safety classification of waste rock stockpiles

The safety classification for the WRDs was determined in accordance with the South African Code of Practice for Mine Residue Deposits (SANS 10286:1998) and the requirements of Mineral Regulation 527 of 23 April 2004. The summarised classifications are included in Table 39.

TABLE 39: SAFETY CLASSIFICATION CRITERIA FOR WASTE ROCK DUMPS

Criteria No.	Criteria		Comment	Safety Classification
1	No. of Residents in Zone of Influence	0 (Low hazard) 1 -10 (Medium hazard >10 (High hazard)	Given the topography, no formal or informal settleing are located within the zone of influence of the proposed projects	Low Hazard
2	No. of Workers in Zone of Influence	<10 (Low hazard) 11 – 100 (Medium hazard) >100 (High hazard)	Minimal workers will be located in the zone of influence as the main activities will take place in the pit areas. Minimal workers will be located in the zone of influence as the main activities will take place the actual shaft area for the Shaft 16 WRD project. Workers responsible for the day-to-day waste handling who will be working at and on the waste dump is also minimal.	Low Hazard
3	Value of third party property in zone of influence	0 – R2 Million (Low hazard) R2 – R20 million (Medium hazard) >R20 million (High hazard)	No formal assessment of the value of property has been done in the zone of influence. The characteristics of the waste rock dumps are such that catastrophic failures will be localised and no extended flow will be experienced.	Low Hazard
4	Depth to underground mine workings	>200 m (Low hazard) 50 m – 200 m (Medium hazard) <50 m (High hazard)	No underground activities are located within the zone of influence	Low Hazard

With reference to Table 39 above, the waste rock stockpiles is classified as a low safety risk.

Environmental classification for the WRDs

In terms of the proposed Pit8C temporary WRD stockpile, although it may be associated with limited leachate contamination that could impact ground and surface water resources, the temporary nature of the stockpiles reduces the environmental risks. It follows that no significant environmental impacts are anticipated.

As is the case with the current Shaft 16 WRD, the WRD expansion may be associated with leachate contamination that could impact ground and surface water resources. Given that the motivation for the

proposed WRD expansion is to improve design characteristics with the single purpose of preventing water pollution, it follows that no significant environmental impacts are anticipated in the mitigated scenario.

Sewage

Sewage will be handled as described under the construction phase in Section 2.7.1.

Power supply

Pit8C

Power for Pit8C will be sourced from portable diesel generators if required.

Shaft 16 WRD expansion

Power for the Shaft 16 WRD expansion will be sourced from Shaft 16.

Water supply and use

Domestic water

Domestic water will be required for both of the proposed projects. This will be sourced from the existing Impala supply via pipelines and/or water trucks.

Water at the Pit8C site

Water is needed for dust suppression along access roads. This water will be obtained from the existing Impala water circuit and will be transported by water trucks.

Process water at the Shaft 16 WRD expansion site

Water will be transported to site by water bowsers.

Water balance

No specific water balance was created for the proposed projects.

Apart from limited potable water requirements, water associated with the proposed Pit8C project will only be required for dust suppression during the opencast mining. Approximately 70 000 l/day will be required and this will be sourced from the Impala circuit. In the unlikely event that water is removed from the pit , it will be used for dust suppression. In the case of the Shaft 16 WRD expansion, there is no additional water requirement.

Stormwater management system

Water management facilities for the control of stormwater and for pollution prevention will be designed to meet the requirements of Regulation 704, 4 June 1999 (Regulation 704) for water management on mines.

The two main principle sections of Regulation 704 that are applicable to the stormwater management of the proposed projects include:

- Regulation 6 which describes the capacity requirements of clean and dirty water systems. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated such that these systems do not spill more than once in 50 years.
- Regulation 7 which requires that measures which must be taken to protect water resources from all dirty water or substances which cause or are likely to cause pollution of a water resource either through natural flow or by seepage.

Pit8C project

In order to manage stormwater generated within the proposed Pit8C project area the following water control measures are proposed:

- **Diversion of clean water using berms:** A clean water diversion berm will be required to divert water generated in the upstream catchment (Figure 11).
- **Containment of dirty water:** In terms of dirty water, the only dirty water generating will be incident rainfall on the proposed Pit8C project area itself. This will be self-contained and there is therefore no need for further stormwater management. Clean water diversion and runoff collection and evaporation measures will be established at the temporary waste rock/overburden stockpiles.

Shaft 16 WRD project

In order to manage stormwater generated at the shaft 16 WRD, the following water control measures are proposed:

- **Diversion of clean water using berms:** Clean water diversion berms and/or channels will be required to divert water generated in the upstream catchment (Figure 11). It is recommended that upstream stormwater be controlled so as to facilitate the rehabilitation process
- **Containment of dirty water:** Clean water diversion and seepage and runoff collection and evaporation measures will be established at the shaft 16 WRD

Disturbance of water courses

Regulation 704 of the NWA requires that mining infrastructure and activities should not be located within 100 m from any watercourse or within the 1:100 year floodline whichever is the greatest.

Pit8C

The proposed Pit8C project site is not located within the 1:100 year or 100 m from any water resources.

Shaft 16 WRD expansion

Although the topographical map indicates the potential for a non-perennial drainage line, according to DWA, the Shaft 16 WRD expansion site is not located within the vicinity of any water courses (Appendix A).

Lighting

Lighting will be required at both project sites for security and night operations where relevant.

Blasting

Structures that can be affected by blasting vibrations

In considering what blast related impacts could be associated with Pit8C, the following spatial analysis is relevant.

TABLE 40: SPATIAL ANALYSIS FOR PIT8C

Distance from Pit8C	Occurrence of infrastructure
500 m	Impala offices, roads, railway line, pipelines, underground workings Power line Ad-hoc grazing cattle
1 km	Impala offices, roads, railway line, pipelines, underground workings, hospital Power line Ad-hoc grazing cattle
1.5 km	Impala offices, roads, railway line, pipelines, underground workings, hospital, hostel Power line Ad-hoc grazing cattle

2.7.3 DECOMMISSIONING PHASE

An overview of the decommissioning activities that will take place on both sites during the decommissioning phase are listed in Table 34 in Section 2.3. Further detail is provided below.

Pit8C

Decommissioning activities will include:

- all surface infrastructure will be removed;
- overburden/waste rock will be used to backfill the pit;
- topsoil will be placed on the top of the overburden/waste rock;
- the surface profile of the backfilled pit will be domed in order to account for the bulking factor and post rehabilitation settling; and
- vegetation will be allowed to re-establish itself on the backfilled area.

Shaft 16 WRD expansion

Decommissioning activities will include:

- shaping and sloping of the footprint to allow for surface water to drain away from the footprint to avoid pooling and seepage of water. (At closure, the the side slopes will have been constructed at an angle of no steeper than 1 vertical:3 horizontal).
- the capping of the waste facility will comprise a 300 mm finely crushed rock layer, a compacted clay layer of 300 mm followed by a topsoil layer of 200 mm;
- vegetation growth will be promoted to reduce the effects of soil erosion and to re-establish landscape functionality; and
- downstream groundwater monitoring will continue to track quality trends.

2.7.4 CLOSURE PHASE

An overview of the closure activities that will take place on site during the closure phase are listed in Table 34 in Section 2.3. Further detail were required is provided below.

Pit8C project site

- there will be a period of active after-care followed by a passive after-care phase;
- removal of any invasive species from the rehabilitated sites; and
- inspecting on an annual basis to repair any erosion gullies;

Shaft 16 WRD expansion site

- there will be a period of active after-care followed by a passive after-care phase;
- maintenance of vegetation over the remaining side slopes and upper surface of the WRD;
- maintenance of facilities such as fencing, fire breaks, access roads and ramps, overflow structures;
- removal of any invasive species from the rehabilitated sites;
- inspecting on an annual basis to repair any erosion gullies; and
- monitoring of potential groundwater pollution plumes associated with the sites, in particular the Shaft 16 WRD expansion.

2.8 PROJECT ALTERNATIVES

2.8.1 SITE SELECTION

Pit8C project site

The proposed new surface infrastructure is surrounded by Impala's current mining activities and as a result no alternative sites have been considered. Further to this, given the location of the ore body, no alternative sites can be considered for the location of the pit. In terms of the mining method, opencast mining is the only feasible method and no other mining method has been considered.

Shaft 16 WRD expansion site

The expansion of the WRD is fixed due to the location of the current approved WRD and constraints associated with the rail, shaft and road infrastructure located to the north, east and south of the current WRD. As such no alternative sites have been considered.

2.8.2 TECHNOLOGY ALTERNATIVES

Pit8C

Opencast mining is the only feasible method and no other mining method has been considered.

Shaft 16 WRD

In comparison to the technology of the current WRD, Impala is proposing design and construction improvements on the expanded section of the existing WRD. In a sense, the alternative to the improvements would be to use the existing technology but this would not address the groundwater pollution concerns.

2.8.3 THE "NO PROJECT" OPTION

The assessment of this option requires a comparison between the options of proceeding with the project with that of not proceeding with the project. Each project component is discussed in further detail below.

The consequence of not proceeding with Pit8C is that the life of the opencast operations at Impala will be reduced which will have negative economic consequences both for the employment of opencast operations workers as well as for optimising resource extraction. The knock-on consequence will be a reduction in the stimulation of the local, regional and national economy.

The consequence of not proceeding with the WRD expansion is that the current WRD will have to be used for waste rock disposal and this may perpetuate the associated pollution concerns.

3 POTENTIAL IMPACTS

3.1 LIST OF POTENTIAL IMPACTS ON ENVIRONMENTAL ASPECTS

This section provides a list of potential impacts on environmental aspects (excluding social and cultural aspects – see Section 6) in respect of each of the main project actions / activities and processes. The potential impacts are presented for each of the project phases in tabular format (Table 41).

TABLE 41: LIST OF POTENTIAL IMPACTS AS THEY RELATE TO PROJECT ACTIONS / ACTIVITIES / PROCESSES (EXCLUDING SOCIAL AND CULTURAL)

Main activity/process	Phase	Impacts (unmitigated)
Site preparation	Construction Operation Decommissioning	Physical destruction of biodiversity General disturbance of biodiversity Air pollution Noise pollution Visual impacts Land use impacts
Earthworks (For all surface infrastructure)	Construction Operation Decommissioning	Hazardous structures/excavations/ surface subsidence Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Air pollution Noise pollution Blasting impact Visual impacts Land use impacts
Civil works Civil works on site relate mainly to any steel and concrete work.	Construction Operation Decommissioning	Hazardous structures/excavations/ surface subsidence Loss of soil resources and land capability through pollution Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Air pollution Noise pollution Visual impacts Land use impacts
Prospecting and survey activities (drilling, reconnaissance and seismic survey)	Construction Operation Decommissioning	Hazardous structures/excavations/ surface subsidence Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Air pollution Noise pollution Visual impacts Land use impacts
Shafts (includes waste rock dumps and crushing)	Construction Operation Decommissioning Closure	Loss and sterilisation of mineral resources Hazardous structures/excavations/ surface subsidence Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Pollution of surface water resources

Main activity/process	Phase	Impacts (unmitigated)
		Alteration of natural drainage patterns Contamination of groundwater Air pollution Noise pollution Visual impacts Land use impacts
Opencast mining	Construction Operation Decommissioning	Loss and sterilisation of mineral resources Hazardous structures/excavations/ surface subsidence Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Dewatering Air pollution Noise pollution Blasting impact Visual impacts Land use impacts
Power and compressed air supply and use	Construction Operation Decommissioning	Hazardous structures/excavations/ surface subsidence Loss of soil resources and land capability through pollution Physical destruction of biodiversity General disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Visual impacts Land use impacts
Water supply and use	Construction Operation Decommissioning	Hazardous structures/excavations/ surface subsidence Loss of soil resources and land capability through pollution Physical destruction of biodiversity General disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Visual impacts Land use impacts
Transport systems	Construction Operation Decommissioning	Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Air pollution Noise pollution Traffic impacts Visual impacts Land use impacts
Non-mineralised waste management (general and industrial hazardous)	Construction Operation Decommissioning	Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Air pollution Visual impacts Land use impacts

Main activity/process	Phase	Impacts (unmitigated)
General site management	Construction Operation Decommissioning Closure	Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Visual impacts Land use impacts
Other support services and amenities	Construction Operation Decommissioning	Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Air pollution Visual impacts Land use impacts
Demolition	Construction Decommissioning	Hazardous structures/excavations/ surface subsidence Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of groundwater Pollution of surface water resources Alteration of natural drainage patterns Air pollution Noise pollution Blasting impact Visual impacts Land use impacts
Rehabilitation	Construction Operation Decommissioning	Hazardous structures/excavations/ surface subsidence Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Air pollution Noise pollution Visual impacts Land use impacts
Maintenance and aftercare	Closure	Hazardous structures/excavations/ surface subsidence Loss of soil resources and land capability through pollution Loss of soil and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Air pollution Visual impacts Land use impacts

3.2 LIST OF POTENTIAL CUMULATIVE IMPACTS

This section provides a list of potential cumulative environmental impacts (excluding social and cultural aspects – see Section 6):

- Hazardous excavations and infrastructure

- Loss of soil resources and land capability through pollution
- Loss of soil resources and land capability through physical disturbance
- Physical destruction of biodiversity
- General disturbance of biodiversity
- Contamination of groundwater
- Dewatering
- Pollution of surface water resources
- Alteration of natural drainage patters
- Air pollution
- Noise pollution
- Blasting impacts (ground vibrations, airblasts and fly rock)
- Visual impacts
- Land use impacts

3.3 POTENTIAL FOR ACID MINE DRAINAGE OR GROUNDWATER CONTAMINATION

Detailed information on these issues is provided in Section 1.1.1. In summary, geochemical tests and analysis indicate that the waste rock stockpiles associated with the proposed projects are non-acid generating, but that there is potential for elevated parameters to leach/seep from both the temporary and permanent waste rock facilities. This presents a pollution risk for both surface and groundwater in both the short and long term.

4 ALTERNATIVE LAND USE OR DEVELOPMENT

4.1 DESCRIPTION OF ALTERNATIVE LAND USE OF THE AREA

Pit8C

The proposed Pit8C site is currently used for existing Impala activities and infrastructure (stores, IT centre, roads, railway line) as well as ad-hoc wood harvesting and cattle grazing. Refer to Section 1.3.4 for a detailed description of existing land uses in the proposed project areas. As an alternative to the development of Pit8C, these current land uses would continue.

Shaft 16 WRD

The proposed Shaft 16 WRD expansion site is currently used for dryland sunflower cultivation with minimal ad-hoc cattle grazing. Refer to Section 1.3.4 for a detailed description of existing land uses in the proposed project areas. As an alternative to the development of the Shaft 16 WRD expansion, these current land uses would continue.

4.2 MAIN FEATURES AND INFRASTRUCTURE RELATED TO ALTERNATIVE LAND USE / DEVELOPMENT

Potential features and infrastructure that could be associated with the alternative land use/development are listed below.

Feature / infrastructure	**Description**	
	Pit8C Site	**Shaft 16 WRD expansion site**
Livestock farming	No features and infrastructure	No features and infrastructure
Impala infrastructure	Stores, IT centre, roads, railway line	No features and infrastructure
Sunflower farming	Not applicable	Preparing and working agricultural fields

4.3 PLAN SHOWING LOCATION AND EXTENT OF ALTERNATIVE LAND USE / DEVELOPMENT

A plan showing the location and extent of the future alternative land use / development is not possible to present at this stage as this would depend on the individual landowners preferences and financial situation. Current alternative land uses are shown on Figure 2.

5 POTENTIAL IMPACTS OF ALTERNATIVE LAND USE OR DEVELOPMENT

5.1 LIST OF POTENTIAL IMPACTS

Potential impacts, expected to occur as a result of the alternative land use / development described in Section 4 above, are listed below:

Feature / infrastructure	Potential impacts
Livestock farming	Increased pressure on veld resources Loss of soils through incorrect management Increased income and associated socio-economic benefits Increased pressure on water resources
Impala infrastructure and activities	Loss of soil resources and land capability through pollution General disturbance of biodiversity Pollution of surface water resources Contamination of groundwater Traffic impacts Air pollution Noise pollution Visual impacts Increased income and associated socio-economic benefits
Sunflower farming	Increased pressure on water resources Potential for soil loss from erosion Destruction of habitat and biodiversity Air pollution

5.2 LIST OF POTENTIAL CUMULATIVE IMPACTS

Potential cumulative impacts associated with the alternative land use, when compared to the existing land use on site and in the surrounding area, are expected to include:

- increased pressure on the quantity and quality of water resources;
- loss of habitat and biodiversity;
- potential for soil losses;
- air pollution; and
- increased income and associated socio-economic benefits.

6 POTENTIAL SOCIAL AND CULTURAL IMPACTS

6.1 LIST OF POTENTIAL IMPACTS ON SOCIO-ECONOMIC CONDITIONS OF THIRD PARTY LAND USE ACTIVITIES

Potential impacts on the socio-economic conditions of other parties' land use activities both on site and in the surrounding area are discussed in detail in Section 1.3.3 and listed below.

- Loss of current land uses through impacts on the bio-physical environment
- Project-related road use and traffic
- Economic impacts (positive and negative)
- Inward migration: Informal settlements, safety, security and services and associated social ills

6.2 CULTURAL ASPECTS AND POTENTIAL IMPACTS THEREON

Cultural aspects are discussed as part of the heritage discussion below.

6.3 HERITAGE FEATURES AND POTENTIAL IMPACTS THEREON

6.3.1 HERITAGE (AND CULTURAL) FEATURES

With reference to Section 1.3.2 no heritage or cultural resources were identified within the proposed project areas, therefore no impacts are expected to occur.

6.3.2 PALAEONTOLOGICAL FEATURES

Given the geology, being the BIC (see Section 1.3.2) there is very limited potential for palaeontological resources to occur, therefore no impacts are expected to occur.

6.4 QUANTIFICATION OF IMPACTS ON SOCIO-ECONOMIC CONDITIONS

Refer to Section 7.2.17 for the impacts associated with the loss of land per hectare as well as Impala's contribution to the provincial and national economy. Refer to Appendix F for the relevant specialist study undertaken.

7 ASSESSMENT AND EVALUATION OF POTENTIAL IMPACTS

7.1 LIST OF EACH POTENTIAL IMPACT

Potential environmental and socio-economic impacts were identified by SLR and other stakeholders. The impacts are discussed under issue headings in this section. All identified impacts are considered in a cumulative manner such that the current baseline conditions on site and in the surrounding area are discussed and assessed together.

Environmental impacts that will be assessed in this section include the following:

- Loss and sterilisation of a mineral resource (7.2.1)
- Hazardous excavations and infrastructure (Section 7.2.2)
- Loss of soil resources through pollution (Section 7.2.3)
- Loss of soil resources and land capability through physical disturbance (Section 7.2.4)
- Physical destruction of biodiversity (Section 7.2.5)
- General disturbance of biodiversity (Section 7.2.6)
- Pollution of water resources (Section 7.2.7)
- Alteration of natural drainage patterns (Section 7.2.8)
- Contamination of groundwater (Section 7.2.9)
- Dewatering (Section 7.2.10)
- Air pollution (Section 7.2.11)
- Noise pollution (Section 7.2.12)
- Blasting impacts (Section 7.2.13)
- Road disturbance and traffic safety (Section 7.2.14)
- Visual impacts (Section 7.2.15)
- Loss of heritage, cultural and palaeontological resources (Section 7.2.16)
- Economic impacts (7.2.17)
- Inward migration impact (Section 7.2.18)
- Land use impact (Section 7.2.19)

7.2 IMPACT RATING FOR EACH POTENTIAL IMPACT

The impact rating for each potential impact is provided in the section below. The criteria used to rate each impact is outlined in Section 7.3. The potential impacts are rated with the assumption that no mitigation measures are applied and then again with mitigation. An indication of the phases in which the impact will occur is provided below and summarised in Section 7.4 together with the estimated timeframes for each rated impact.

GEOLOGY

7.2.1 ISSUE: LOSS AND STERILISATION OF MINERAL RESOURCE

Information in this section was sourced from the project team.

Introduction

Mineral resources can be sterilised and/or lost through the placement of infrastructure and activities in close proximity to mineral resources, by preventing access to potential mining areas, and through the disposal of mineral resources onto mineralised waste facilities.

It is unlikely that the position of the Shaft 16 WRD expansion will sterilise underlying resources as the known ore body is located more than a kilometre below the surface.

The proposed Pit8C could be associated with sterilisation because of the safety requirement of leaving a barrier between the pit and any potential underground mine workings.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Shaft WRD Opencast mining	Shaft WRD Opencast mining	Shaft WRD Opencast mining	Shaft WRD

Severity / nature

The severity of sterilising mineral resources is considered to be high because of the associated potential economic value that is lost when sterilisation occurs.

In the unmitigated scenario, the proposed Pit8C project could lead to minerals being sterilised because of the requirement of leaving a safety barrier between opencast workings and potential underground workings. It it unlikely that the Shaft 16 WRD expansion will sterilise underlying resources as the known ore body is located more than a kilometre below the surface, however there is potential for minerals within the waste rock itself to be sterilised if this cannot be accessed after waste rock disposal. Given the potential economic loss associated with the sterilisation of minerals, this impact severity is considered medium.

In the mitigated scenario, planning and co-ordination between the mining, infrastructure projects and processing decision makers can help to prevent the unacceptable sterilisation of resources, without compromising safety requirements. The mitigated severity reduces to low.

Duration

If sterilisation of resources occurs it is likely that the related impact will extend beyond the life of Impala. This is a long term duration.

Spatial scale / extent

In the first place, the spatial extent of the physical impact is linked to the spatial extent of the proposed project areas. This is a localised spatial extent. If one considers the economic nature of the impact, it will extend beyond the site into the broader economy.

Consequence

The unmitigated consequence is high. The mitigated consequence is medium.

Probability

In the mitigated scenario, Impala has planning structures in place to avoid infrastructure and development sterilisation. As indicated above, the ore body is located 1 km below the proposed Shaft 16 WRD expansion, and the associated probability of mineral sterilisation therefore low. Similarly, current planning at Impala makes provision for processing waste rock as required and/or making it available to third parties for crushing and use as aggregate. In terms of the Pit8C project, despite the requirement of leaving a safety barrier between opencast workings and potential underground workings, the purpose of the proposed project is to optimise resource extraction. As such, the probabily in both the mitigated and unmitigated scenario is low.

Significance

The unmitigated significance is medium. In the mitigated scenario the significance is low.

Unmitigated – summary of the rated loss and sterilisation of mineral resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation, decommissioning and closure						
Unmitigated	M	H	M	H	L	M

Mitigated – summary of the rated loss and sterilisation of mineral resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation, decommissioning and closure						
Mitigated	L	H	M	M	L	L

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19).

Objective

To prevent unacceptable mineral sterilisation.

Actions

Impala will continue to incorporate cross discipline planning structures associated with the development of both the proposed Pit8C and Shaft 16 WRD expansion projects. A key component of the cross cutting function is communication with the underground and surface mining managers.

Where feasible, Impala will continue to make provision for the processing of waste rock and/or allowing third parties to crush and use it for aggregate.

Emergency situations

None identified.

TOPOGRAPHY

7.2.2 ISSUE: HAZARDOUS EXCAVATIONS AND INFRASTRUCTURE

Information in this section was sourced from the project team.

Introduction

Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. Included in this category are facilities that can fail and surface subsidence associated with mining areas. Hazardous excavations and infrastructure occur in all mine phases from construction through operation to decommissioning and closure. In the construction and decommissioning phases these hazardous excavations and infrastructure are usually temporary in nature, usually existing for a few weeks to a few months. Given the temporary nature of the proposed Pit8C project the presence of hazardous excavations and infrastructure will remain a safety risk for the duration of the project and the maintenance and aftercare phase in which subsidence may occur. In regard to the proposed Shaft 16 WRD expansion, this will remain in perpetuity and therefore remain a long term safety risk.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Demolition Rehabilitation	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Rehabilitation	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Demolition Rehabilitation	Shaft WRD Maintenance and aftercare

Rating of impact

Severity/ nature

In the unmitigated scenario, in all project phases, most of the identified hazardous excavations and infrastructure present a potential risk of injury and/or death to both people and animals for all the proposed projects. This is a potential high severity.

In the mitigated scenario the severity reduces to medium as security and access control will be implemented at all project sites, and the design of the Pit8C and Shaft 16 WRD expansion components will be implemented to prevent and/or mitigate impacts.

Duration

In the context of this assessment, death or permanent injury is considered a long term, permanent impact.

Spatial scale/ extent

Direct impacts associated with hazardous infrastructure and excavations for both projects will be located within the site boundary in all project phases, with or without mitigation. The potential indirect impacts for the proposed projects will extend beyond the site boundary to the communities to which the injured people and/or animals belong.

Consequence

The consequence is high in both the unmitigated and mitigated scenarios.

Probability

In the unmitigated scenario, without design and management interventions the impact probabability is expected to be medium. The mitigation measures will focus on infrastructure safety design and implementation as well as on limiting access to third parties and animals which reduces the probability of the impact occurring. Moreover, when considered cumulatively in the context of the surface use area, records show that with mitigation the number of safety incidents is limited. In the mitigated scenario, the impact probability reduces to low.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance of this potential impact is medium because there will be a reduction in probability that the impact occurs.

Unmitigated – summary of the rated hazardous excavations and infrastructure impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	M	H

Mitigated – summary of the rated hazardous excavations and infrastructure impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	H	M	H	L	M

Conceptual description of proposed mitigation measures

Discussion of the mitigation measures is provided below and tabulated in the EMP (Section 19).

Objectives

The objective is to prevent physical harm to third parties and animals from potentially hazardous excavations and infrastructure.

Actions

The proposed Pit8C and Shaft 16 WRD expansion will be designed, constructed, operated and closed in a manner to ensure that stability and related safety risks to third parties and animals are addressed. These issues will be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer.

Impala will survey both of the proposed project areas and update its surface use area map on a routine basis to ensure that the position and extent of all potential hazardous excavations, hazardous infrastructure and subsidence is known. It will furthermore ensure that appropriate management measures are taken to address the related safety risks to third parties and animals.

During construction and operation of the proposed projects, the safety risks associated with identified hazardous excavations, subsidence and infrastructure will be addressed through one or more of the following:

- fencing, berms, barriers and/or security personnel to prevent unauthorised access; and
- warning signs in the appropriate language(s). Warning pictures can be used as an alternative.

During decommissioning planning of any part of all the proposed project areas, provision will be made to address long term safety risks in the decommissioning and rehabilitation phases.

At closure, the hazardous infrastructure will either have been removed or decommissioned and rehabilitated in a manner that it does not present a long term safety and/or stability risk.

At closure the hazardous excavations and subsidence associated with the proposed opencast projects will have been dealt with as follows:

- Pit8C will have been backfilled and rehabilitated;
- the potential for surface subsidence will be addressed by providing a bulking factor for the backfilled pit;
- monitoring and maintenance will take place to observe whether the relevant long term safety objectives have been achieved and to identify the need for additional intervention where the objectives have not been met.

For the WRD expansion, at closure the side slopes will have been constructed at an angle of no steeper than 1 vertical:3 horizontal. A growth medium will have been placed on top of the rock and vegetation re-established.

Where Impala has caused injury to third parties and/or animals, appropriate compensation will be provided.

Emergency situations

If people or animals fall off or into hazardous excavations or infrastructure causing injury, the Impala emergency response procedure will be initiated.

SOILS AND LAND CAPABILITY

7.2.3 ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH POLLUTION

Information in this section was based on soil specialist studies conducted by ESS for the entire Impala converted mining rights area (ESS 2011).

Introduction

Soil is a valuable resource that supports a variety of ecological functions. The proposed projects have the potential to damage soil resources through physical disturbance and/or contamination. Contamination of soils also has the potential to impact both surface and groundwater resources (see Sections 7.2.7 and 7.2.9, for water related impacts). The loss of soil resources has a direct impact on the potential loss of the natural capability of the land. This section therefore focuses directly on the potential for disturbance and contamination of the soil resources and the effect this has on land capability.

There are a number of sources in all phases that have the potential to pollute soil resources. In the construction and decommissioning phases these activities are temporary in nature, usually existing from a few weeks to a few months. The operational phase will present more long term activities and the closure phase will present final land forms.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Support services and amenities Demolition Rehabilitation	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Support services and amenities Rehabilitation	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Support services and amenities Demolition Rehabilitation	Shaft WRD General site management Maintenance and aftercare

Rating of impacts

Severity/nature

In the unmitigated scenario, pollution of soils from numerous incidents associated with both proposed projects can result in a loss of soils as an ecological driver (and associated land capability) because it can create a toxic environment for vegetation and ecosystems that rely on the soil. This is a high severity in the unmitigated scenario when considered both incrementally for each site and cumulatively in the context of the current soil disturbance potential within the Impala surface use area.

In the mitigated scenario the number of pollution events should be significantly less which reduces the potential severity to medium.

Duration

In the unmitigated scenario, most pollution impacts and associated loss in land capability will remain long after closure for both of the proposed projects. In the mitigated scenario most of these potential impacts should either be avoided or be remedied within the life of the proposed projects, which reduces the duration to low. This will be achieved by the effective reaction time of the clean-up team and the chosen remediation methods.

Spatial scale/extent

In both the unmitigated and mitigated scenarios for all phases relative to all the proposed projects, the potential loss of soil resources and associated land capabilities will be restricted to within the site boundary.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is reduced to low as the severity and duration of the impact is reduced.

Probability

Without any mitigation the probability of impacting on soils and land capability through pollution events is high. With mitigation, the probability will be reduced to low because emphasis will be placed on preventing pollution events and on quick and effective remediation if pollution events do occur.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance reduces to low because with mitigation the severity, duration and probability associated with the potential impact are all reduced.

Unmitigated – summary of the rated loss of soil resources and land capability through pollution impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	L	H	H	H

Mitigated – summary of the rated loss of soil resources and land capability through soil pollution impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	L	L	L	L	L

Conceptual description of proposed mitigation measures

Conceptual discussion of the mitigation measures is provided below and detailed in the EMP (Section 19).

Objectives

The objective is to prevent soil pollution.

Actions applicable to all phases

In the construction, operation and decommissioning phases Impala will ensure that all dirty water, mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute soils. This will be implemented through a procedure(s) covering the following:

- pollution prevention through basic infrastructure design pollution prevention through maintenance of equipment (relevant to all projects);
- pollution prevention through education and training of permanent and temporary workers (relevant to both projects);

- pollution prevention through appropriate management of hazardous materials and wastes (relevant to the development of both the proposed Pit8C and Shaft 16 WRD expansion projects);
- the required steps to enable fast reaction to contain and remediate pollution incidents. In this regard the remediation options include containment and in situ treatment or disposal of contaminated soils as hazardous waste. In-situ treatment is generally considered to be the preferred option because with successful in situ remediation the soil resource will be retained in the correct place. The in situ options include bioremediation at the point of pollution, or removal of soils for washing and/or bio remediation at a designated area after which the soils are returned (relevant to both projects); and
- specifications for post rehabilitation audit criteria to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and if not, to recommend and implement further measures (relevant to both projects).

The designs of any permanent and potentially polluting structures (such as the proposed WRD expansion) will take account of the requirements for long term soil pollution prevention, land function and confirmatory monitoring.

Emergency situations

Major spillage incidents will be handled in accordance with the Impala emergency response procedure.

7.2.4 ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

Information in this section was based on soil specialist studies conducted by ESS for the entire Impala converted mining rights area (ESS 2011).

Introduction

Soil is the key to re-establishing post closure land capability. There are a number of activities/infrastructure in all phases that have the potential to disturb soils and related land capability through removal, compaction and/or erosion. The proposed Pit8C and associated infrastructure will disturb an area of approximately 5 ha. The proposed Shaft 16 WRD expansion will disturb an area of approximately 19 ha. In the construction and decommissioning phases these activities could be temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term activities and the closure phase will present final land forms that may be susceptible to erosion.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Prospecting and survey activities Shaft WRD Opencast mining	Earthworks Prospecting and survey activities Shaft WRD Opencast mining	Earthworks Prospecting and survey activities Shaft WRD Opencast mining	Shaft WRD General site management Maintenance and aftercare

Construction	Operational	Decommissioning	Closure
Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation	Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	

Rating of impact

Severity/nature

In the unmitigated scenario, physical soil disturbance can result in a loss of soil functionality as an ecological driver. In the case of erosion, the soils can be lost to the area of disturbance even though experience has shown that the turf types soils are less susceptible to erosion. In the case of compaction the soils functionality will firstly be compromised through a lack of rooting ability and aeration, and secondly the compacted soils are more likely to erode because with less inherent functionality there will be less chance for the establishment of vegetation and other matter that naturally protects the soils from erosion. Any soils that remain beneath the permanent landforms (WRD) will be a lost resource and the associated land capability will be permanently altered. This amounts to a high severity when considered both incrementally for each site and cumulatively in the context of the current soil disturbance potential within the Impala surface use area.

In the mitigated scenario, the soils can be conserved and reused to establish land capabilities. This does not apply to the soils that will remain under the WRD and associated land capability of this footprint. In total this reduces the high unmitigated severity to medium.

Duration

In the unmitigated scenario the loss of soil and related land capability is long term and will continue after the life of the proposed projects. In the mitigated scenario, the soil is conserved and replaced in all areas which reduces the duration of the impact to the life of the proposed operations, therefore to a low duration. However for both the unmitigated and mitigated scenarios the Shaft 16 WRD expansion, land capability will be altered forever.

Spatial scale/extent

In both the unmitigated and mitigated scenarios for all phases of the project, the potential loss of soil and land capability through physical disturbance will be restricted to within the site boundary for all the proposed projects.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is low for the proposed Pit8C project as the severity and duration of the impact are reduced. For the Shaft 16 WRD expansion, the consequence reduces to medium because the duration remains long term.

Probability

Without any mitigation the probability of losing soil and related land capability is definite. With mitigation, the probability will be reduced because emphasis will be placed on soil conservation and re-establishment. In the case of the proposed WRD expansion while some topsoil can be conserved and used for dump rehabilitation, the probability of a land capability change will remain high as the proposed Shaft 16 WRD expansion will remain in perpetuity.

Significance

In the unmitigated scenario the impact is high for both the proposed projects. In the mitigated scenario the significance of this impact is reduced to low as the severity, duration and probability are reduced.

Unmitigated – summary of the rated loss of soil resources and land capability through physical disturbance impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	L	H	H	H

Mitigated – summary of the rated loss of soil resources and land capability through physical disturbance impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	L	L	L (M for WRD)	L (H for WRD)	L (M for WRD)

Conceptual description of proposed mitigation measures

Discussion of the mitigation measures is provided below and tabulated in the EMP (Section 19).

Objective

The objective is to minimise the loss of soil resources and related land capability through physical disturbance, erosion and compaction.

Actions

In the construction, operation and decommissioning phases a soil management plan, with the following key components, will be implemented:

- limit the disturbance of soils to what is absolutely necessary for earthworks, on-going activities, infrastructure footprints and use of vehicles; and
- where soils have to be disturbed the soil will be stripped, stored, maintained and replaced in accordance with the specifications of the soil management principles in Table 42 and the detailed Impala soils management procedure.

TABLE 42: SOIL MANAGEMENT PRINCIPLES

Steps	Factors to consider	Detail
Delineation of areas to be stripped		Stripping will only occur where soils are to be disturbed by activities and infrastructure that are described in the EIA/EMP report, and where a clearly defined end rehabilitation use for the stripped soil has been identified. No stripping is planned for the temporary WRD associated with opencast operations.
Reference to biodiversity mitigation		All requirements for moving and preserving fauna and flora according to the biodiversity mitigation measures will be adhered to.
Stripping	Topsoil	As a general requirement, a minimum of 50 cm topsoil will be stripped unless a soils expert advises otherwise. In the case of the tailings dam footprints the stripping depth is determined by the requirement to leave in situ clay for the liner. Therefore the estimated average depth is 20cm. In the case of the permanent WRD expansion project, a cap comprising of 30 cm clay subsoil and 20 cm topsoil is required for rehabilitation and closure, therefore stripping must be adequate to provide for this.
	Subsoil	If present, subsoil will be removed and stockpiled separately to the topsoil.
Delineation of stockpiling areas	Location	Stockpiling areas will be identified in close proximity to the source of the soil to limit handling and to promote reuse of soils in the correct areas.
	Designation of the areas	Soil stockpiles will be clearly identifiable in terms of soil type and the intended areas of rehabilitation.
Stockpile management	Vegetation establishment and erosion control	Rapid growth of vegetation on the topsoil stockpiles will be promoted (e.g. by means of watering or fertilisation). The purpose of this exercise will be to encourage vegetation growth on soil stockpiles and to combat erosion by water and wind.
	Storm water controls	Stockpiles will be established with storm water diversion berms to prevent run off erosion.
	Height and slope	Soil stockpiles height will be controlled to avoid compaction and damage to the underlying soils. The stockpile side slopes should be flat enough to promote vegetation growth and reduce run-off related erosion.
	Waste	No waste material will be placed on the soil stockpiles.
	Vehicles	Equipment movement on top of the soil stockpiles will be limited to avoid topsoil compaction and subsequent damage to the soils and seedbank.
Rehabilitation of disturbed land: restoration of land capability	Placement of soil	A minimum layer of 50 cm of topsoil will be replaced unless a soils expert advises otherwise.
	Fertilisation	Samples of stripped soils will be analysed to determine the nutrient status of the soil before rehabilitation commences. As a minimum the following elements will be tested for: cation exchange capacity, pH and phosphate. These elements provide the basis for determining the fertility of soil. Based on the analysis, fertilisers will be applied if necessary.
	Erosion control	Erosion control measures will be implemented to ensure that the topsoil is not washed away and that erosion gulley's do not develop prior to vegetation establishment.

Steps	Factors to consider	Detail
	Restore land function and capability	Apply landscape function analysis and restoration interventions to areas where soil has been replaced as part of rehabilitation, but the land function and capability has not been effectively restored.

As part of closure planning, the designs of any permanent landforms (eg. mineralised waste facilities) will be take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring.

Emergency situations

None identified.

BIODIVERSITY

By way of introduction to this section of the impact assessment, The International Council for Mining and Metals (ICMM) has been instrumental in research and development of good environmental practices in mining. The ICMM's Good Practice Guidance for Mining and Biodiversity provides some useful insights into issues around biodiversity. In the broadest sense, biodiversity provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. The known ecosystem related value is listed as follows:

- soil formation and fertility maintenance;
- primary production through photosynthesis, as the supportive foundation for all life;
- provision of food and fuel;
- provision of shelter and building materials;
- regulation of water flows and water quality;
- regulation and purification of atmospheric gases;
- moderation of climate and weather;
- control of pests and diseases; and
- maintenance of genetic resources (key for medicines, crop and livestock breeding).

The assessment covers the following broad issues: physical destruction of biodiversity and related functions, and general disturbances to biodiversity. Each of these issues is individually assessed below.

It must also be noted that the secondary impacts on biodiversity associated with soil erosion, soil compaction, and physical disturbance and pollution of soils have already been assessed in Sections 7.2.3 and 7.2.4 and will not be repeated below.

7.2.5 ISSUE: PHYSICAL DESTRUCTION OF BIODIVERSITY

Information in this section was sourced from the biodiversity study undertaken by the North West University (NWU, November 2010)

Introduction

There are a number of activities/infrastructure in all phases that have the potential to destroy biodiversity in the broadest sense. In this regard, the discussion relates to the physical destruction of specific biodiversity areas, of linkages between biodiversity areas and related species which are considered to be significant because of their status, and/or the role that they play in the ecosystem.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air use and supply Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	Site preparation Earthworks Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air use and supply Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation	Site preparation Earthworks Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air use and supply Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	Shaft WRD General site management Maintenance and aftercare

Rating of impact

Severity/nature

The proposed Shaft 16 WRD expansion site has already been disturbed by agricultural activities such as dryland sunflower cultivation and ad-hoc grazing and in addition to this, is not located within any of the high biodiversity areas identified within the Impala surface use area. No material disturbance impact on biodiversity has been identified and it follows that the severity is low in both the mitigated and unmitigated scenarios.

The proposed Pit8C site has been partially disturbed as a result of existing surrounding mining activities and infrastructure as well as ad-hoc cattle grazing. Although the site is not located within any high biodiversity areas identified within the Impala surface use area, when considered cumulatively, part of the site is vacant and this patch of veld provides a habitat for flora and fauna species whilst at the same time serving as an ecological corridor for the movement of animals within the Impala surface use area.

In the unmitigated scenario for the Pit8C project, the severity is medium because although the site itself is not considered to be a pristine or a self-contained functional system, there is some value in its role as a potential ecosystem corridor providing linkage between larger more significant areas.

In the mitigated scenario, with correct management and concurrent rehabilitation the severity reduces to low in the case of the Pit8C project.

Duration

In the unmitigated scenario, the loss of biodiversity and related functionality is long term and will continue after the life of the proposed projects. In the mitigated scenario, biodiversity and related functionality may be partially restored during the operational, decommissioning and closure phases for both projects and in this regard, the duration reduces to medium.

Spatial scale / extent

Given that biodiversity processes are not confined to the proposed project areas, the spatial scale of impacts will extend beyond this boundary in both the mitigated and unmitigated scenario. Key related issues are the migration of species, the flow of nutrients and linkages between biodiversity areas. This is a medium spatial scale.

Consequence

In the unmitigated scenario, the consequence of this potential impact for Pit8C and Shaft 16 WRD are high and medium respectively. With mitigation, the consequence reduces to low for both projects.

Probability

Without mitigation the probability associated with the proposed projects is definite. With mitigation, the probability may be reduced to medium/low with correct mitigation measures and concurrent rehabilitation.

Significance

The significance of this impact is high in the unmitigated scenario (medium for WRD expansion). In the mitigated scenario the significance is medium during the construction, operation and decommissioning phases and reduces to low at closure.

Unmitigated – summary of the rated physical destruction of biodiversity impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M (L for WRD)	H	M	H (M for WRD)	H	H (M for WRD)

Mitigated – summary of the rated physical destruction of biodiversity impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	M	M	L	M-L	M-L

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to prevent the unacceptable loss of biodiversity and related ecosystem functionality through physical disturbance.

Actions

In the construction, operation and decommissioning phases Impala will implement a biodiversity management plan. The key components are:

- to limit mine infrastructure, activities and related disturbances to those specifically identified and described in this report;
- to prevent the disturbance of areas of significance and important linkages between these areas so that the species composition and ecosystem functionality remain intact;
- where a new area will be disturbed, the following process will be implemented:
    - delineation of proposed area to be disturbed,
    - maintaining linkages between protection areas
    - relocation of species that can effectively be relocated (especially protected species and species of conservation concern),
    - restoration of the ecosystem functionality, as far as is possible, in areas that have been physically rehabilitated;
    - follow up audits and monitoring, in the short and long term, to determine the success of the relocation, rehabilitation and restoration activities in terms of a range of species and ecosystem function performance indicators; and
- implementation of an alien/invasive/weed management programme to control the spread of these plants onto and from disturbed areas through active eradication, establishment of natural species and through on-going monitoring and assessment. In this regard, the use of herbicides will be controlled by only allowing registered Pest Control Operators (PCO) to administer any such chemical or biological agent.

As part of closure planning, the designs of any permanent structures (mineralised waste facilities) will take into consideration the requirements for the establishment of long term species diversity, ecosystem functionality, aftercare and confirmatory monitoring.

Emergency situations

None identified.

7.2.6 ISSUE: GENERAL DISTURBANCE OF BIODIVERSITY

Information in this section was sourced from the biodiversity study (NWU, November 2010) included in Appendix E.

Introduction

There are a number of activities/infrastructure that have the potential to directly disturb vegetation, vertebrates and invertebrates in all project phases, particularly in the unmitigated scenario. In the construction and decommissioning phases these activities are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term occurrences and the closure phase will present final land forms (Shaft 16 WRD expansion) that may have pollution potential through long term seepage and/or run-off.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Civil works Earthworks Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	Site preparation Civil works Earthworks Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation	Site preparation Civil works Earthworks Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	Shaft WRD General site management Maintenance and aftercare

Rating of impact

Severity / nature

In the unmitigated scenario, biodiversity will be disturbed in the following ways:

- Lighting can attract large numbers of invertebrates which become easy prey for predators. This can upset the invertebrate population balances;
- power lines can lead to bird kills;
- people may kill various types of species for food, for sport, for fire wood etc;
- people may illegally collect and remove vegetation, vertebrate and invertebrate species;
- excessive dust fallout from various dust sources may have adverse effects on the growth of some vegetation, and it may cause varying stress on the teeth of vertebrates that have to graze soiled vegetation;
- noise and vibration pollution may scare off vertebrates and invertebrates. In some instances the animals may be deterred from passing close to noisy activities which can effectively block some of

their migration paths. In other instances, vertebrates and invertebrates that rely on vibration and noise senses to locate for, and hunt, prey may be forced to leave the vicinity of noisy, vibrating activities;

- the presence of vehicles in the area can cause road kills especially if drivers speed;
- the presence of mine water impoundments and pipelines may lead to drowning of fauna; and
- pollution emissions and general litter may directly impact on the survival of individual plants, vertebrates and invertebrates.

Taken together, both incrementally for the project sites and cumulatively within the Impala surface use area, the disturbances will have a medium severity in the unmitigated scenario for both projects. In the mitigated scenario, many of these disturbances can be prevented or mitigated to acceptable levels, which reduces the severity to low.

Duration

In both the mitigated and unmitigated scenarios, the impacts are long term because where biodiversity is compromised, killed or removed from the area this impact is likely to exist for the life of the project and possibly beyond. In the mitigated scenario, this duration reduces to medium.

Spatial scale / extent

Given that biodiversity processes are not confined to the proposed project sites, the spatial scale will extend beyond the site boundary in the unmitigated scenario. Key related issues are the migration of species and linkages between biodiversity areas. The spatial scale is therefore medium for both projects in the unmitigated as well as the mitigated scenario.

Consequence

In the unmitigated scenario, the consequence of this potential impact is medium. In the mitigated scenario, this reduces to low because the severity and the duration of the impact are reduced.

Probability

Without any mitigation the probability of negatively impacting on biodiversity through multiple disturbance events is high. With mitigation, the probability will be reduced to medium/low because most of the disturbances can be controlled through implementation and enforcement of practices, policies and procedures.

Significance

In the unmitigated scenario, the significance of this potential impact is medium. In the mitigated scenario, the significance is reduced to low because the associated consequence and probability are reduced.

Unmitigated – summary of the rated general disturbance of biodiversity impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M	H	M	M	H	M

Mitigated – summary of the rated general disturbance of biodiversity impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	M	M	L	M-L	M-L

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Sections 19).

Objective

The objective of the management measures is to prevent unacceptable disturbance of biodiversity and related ecosystem functionality.

Actions

In the construction, operation and decommissioning phases the mine will ensure that:

- the use of light is kept to a minimum, and where it is required, yellow lighting is used where possible;
- vertebrates should be kept away from the illuminated areas with appropriate fencing where feasible;
- internal power lines may be equipped with bird deterrent measures to prevent bird kills where deemed necessary;
- there is training for workers on the value of biodiversity and the need to conserve the species and systems that occur within the proposed project areas;
- there is zero tolerance of the killing or collecting of any biodiversity by anybody working for or on behalf of Impala;
- strict speed control measures are used for any vehicles driving within the proposed surface use areas;
- noisy and/or vibrating equipment will be well maintained to control noise and vibration emission levels;
- dust control measures will be implemented (see section 7.2.11); and
- pollution and litter prevention measures will be implemented (see section 7.2.3 and 7.2.7).

As part of closure planning, the designs of any permanent and potentially polluting structures (proposed Shaft 16 WRD expansion) will take consideration of the requirements for long term pollution prevention and confirmatory monitoring.

Emergency situations

Major spillage incidents will be handled in accordance with the Impala emergency response procedure.

SURFACE WATER

7.2.7 ISSUE: POLLUTION OF SURFACE WATER RESOURCES

Information for this section was sourced from site visits conducted by the EIA project team, and the surface water study (Metago, September 2011).

Introduction

The proposed projects could result in an alteration of drainage patterns, as well as potentially contaminate surface water resources. These issues are assessed separately below.

There are a number of pollution sources in all project phases of all the proposed projects that have the potential to pollute surface water, particularly in the unmitigated scenario. In the construction and decommissioning phases these potential pollution sources are temporary in nature. Although these sources may be temporary, the potential pollution may be long term. The operational phase will present more long term potential sources and the closure phase will present final land forms such as the proposed WRD expansion at Shaft 16 that may have the potential to contaminate surface water through long term seepage and/or run-off.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works Prospecting and survey activites Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	Earthworks Civil works Prospecting and survey activites Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation	Earthworks Civil works Prospecting and survey activites Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	Shaft WRD General site management Maintenance and aftercare

Rating of impacts

Severity/nature

In the unmitigated scenario, surface water run-off may collect contaminants. The temporary and permanent WRDs are point sources of potential contaminants. In addition, there are various potential diffuse sources including erosion sediment, spillage of sewage, fuel, lubricants and dirty water.

At elevated concentrations these contaminants may exceed the relevant limits imposed by DWA (these limits may be subject to periodic revision in consultation with DWA) and can be harmful to humans and livestock if ingested directly and possibly even indirectly through contaminated vegetation, vertebrates

and invertebrates (impacts on biodiversity have been assessed in Section 7.2.6 and will not be reassessed in this section). The related unmitigated severity is high.

In the mitigated scenario, clean water will be diverted away from the project areas and contaminated run-off and process water will be contained and re-used in the normal course. The severity can therefore be reduced to low.

Duration

In the unmitigated scenario, the potential health impacts are long term, occurring for periods longer than the life of proposed projects. With mitigation, pollution can be prevented and/or most of the health impacts can be reversed or mitigated within the life of proposed projects.

Spatial scale / extent

In the mitigated and unmitigated scenarios the spatial scale is likely to extend beyond the proposed project area because contamination is mobile once it reaches flowing water courses. This will be more of an issue in the rainy season because most of the watercourses are non-perennial. The spatial scale of both projects is therefore expected to be medium in both the mitigated and unmitigated scenarios.

Consequence

In the unmitigated scenario the consequence is high and in the mitigated scenario it is low.

Probability

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- Does contamination reach surface water resources?
- Will people and animals utilise this contaminated water?
- Is the contamination level harmful?

The first element is that contamination reaches the surface water resources adjacent to the proposed project areas. This is likely because current monitoring data for downstream water quality (both projects) indicates that the concentration for various parameters is already elevated. The second element is that third parties and/or livestock use this contaminated water for drinking purposes. There is a possibility for this to occur, albeit limited, because of the fact that most of the villages surrounding the proposed project areas are provided with reticulated water and the fact that most of the surface water courses only contain surface water in the rainy season which means that livestock are provided with water points that do not rely on surface water. The third element is that it is likely that some contaminants will be at a level which is harmful to humans and livestock. This is cumulatively influenced by the quality of any discharged water, by the quality of the water in the receiving water resource and by the diluting effect of any rainwater particularly in the rainy season. As a combination, the unmitigated probability is high and the mitigated probability is low for both projects.

Significance

In the unmitigated scenario, the significance of this potential cumulative impact is high. In the mitigated scenario, the significance is reduced to low because of the reduction in consequence and probability.

Unmitigated – summary of the rated pollution of water resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H

Mitigated – summary of the rated pollution of water resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	L	M	L	L	L

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to prevent pollution of surface water resources and related harm to surface water users.

Actions

Impala will comply with the terms and conditions of water authorisations/licenses.

In all phases, infrastructure associated with the proposed projects will be constructed, operated and maintained so as to comply with the provisions of the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto. Key related issues are to ensure that:

- clean water systems are separated from dirty water systems;
- the location of all activities and infrastructure should be outside of the specified zones and/or floodlines of watercourses;
- the size of dirty areas are minimised and dirty water is contained in systems (in compliance with both Regulation 704 and Section 73 of Regulation 527) that allow the reuse and/or recycling of this dirty water;
- discharges of dirty water may only occur in accordance with authorisations that are issued in terms of the relevant legislation specifications and they must not result in negative health impacts for downstream surface water users. The relevant legislation specifications comprises any applicable authorisation/exemption, the National Water Act (36 of 1998) and Regulation 704, or any future amendment thereto; and
- the site wide water balance is refined on an on-going basis with the input of actual flow volumes and used as a decision making tool for water management and impact mitigation.

In the construction, operation and decommissioning phases the mine will ensure that all mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute surface water. This will be implemented through a procedure(s) covering the following:

- pollution prevention through basic infrastructure design pollution prevention through maintenance of equipment;
- pollution prevention through education and training of workers (permanent and temporary);
- pollution prevention through appropriate management of hazardous materials and waste;
- the required steps to enable containment and remediation of pollution incidents; and
- specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.

The designs of any permanent and potentially polluting structures will take account of the requirements for long term surface water pollution prevention. Moreover, where these facilities are associated with groundwater plumes that have or will impact the quality of surface water resources, Impala will implement mitigation measures for as long as is needed to eliminate the risk and achieve the stated mitigation objectives. An example of such a solution is to pump and treat the polluted groundwater so that it does not impact surface water resources.

Impala will monitor the water quality (Section 21) in all potentially affected surface water resources and use the monitoring results to implement appropriate mitigation measures to achieve the surface water quality objectives.

Where monitoring results indicates that third party water supply has been polluted by Impala, Impala will ensure that an alternative equivalent water supply is available.

Emergency situations

Discharge incidents that may result in pollution of surface water resources will be handled in accordance with the Impala emergency response procedure.

7.2.8 ISSUE: ALTERATION OF NATURAL DRAINAGE PATTERNS

Information for this section was sourced from site visits conducted by the EIA project team, and the surface water study (Metago, September 2011).

Introduction

There are a number of activities/infrastructure, in all project phases which could alter the drainage patterns either by reducing the volume of run-off into the downstream catchments or by impeding the preferential flow paths for stormwater run-off. With reference to the table below, there are a number of

activities/infrastructures which will alter drainage patterns either by reducing the volume of run-off into the downstream catchments or through their location within preferential flow paths.

Both the proposed Pit8C project and Shaft 16 WRD expansion will require stormwater management facilities (berms and canals) to facilitate the diversion of water around dirty areas. During the decommissioning phase, these activities will continue until such time as project infrastructure can be removed and/or the project areas are rehabilitated. During the closure phase rehabilitation will allow for the restoration of drainage patterns. Due to the fact the the WRD expansion will remain in perpetuity, it may be necessary for stormwater controls to be permanent features.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works Prospecting and survey activites Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	Earthworks Civil works Prospecting and survey activites Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation	Earthworks Civil works Prospecting and survey activites Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	Shaft WRD General site management Maintenance and aftercare

Rating of impacts

Severity / nature

During the construction, operation, decommissioning, and to a lesser extent, the closure phases, rainfall and surface water run-off will be collected in all areas that have been designed with water containment infrastructure. The collected run-off will therefore be lost to the catchment and can result in the alteration of drainage patterns. The amount of collected runoff will be negligible and will therefore not serve as a substantial loss of run-off to the surface use area (the total MAR). By isolating each of the project areas, the Pit8C infrastructure will reduce the run-off in its catchment by approximately 0.003 % and the WRD will reduce the run-off in its catchment by approximately 0.03 %. In the context of the affected quaternary catchments (whether considered incrementally for each site of cumulatively for the Impala surface use area), this is considered to be a medium severity because although the reduction is minimal and will not result in a substantial deterioration in the water reserve and downstream water uses, the drainage patterns will be altered for the duration of the projects operational phase. The overall medium severity rating applies in both the unmitigated (all phases) and mitigated scenarios (prior to closure).

After closure, in the mitigated scenario, both of the sites will be rehabilitated to re-establish landscape functionality and surface water runoff will no longer be contained. The associated severity reduces to low.

Duration

In the unmitigated scenario, the alteration of drainage patterns will extend beyond closure. In the mitigated scenario, the duration of the alterations will mostly be restricted to the phases before closure.

Spatial scale / extent

In the mitigated and unmitigated scenario the physical alteration of drainage patterns will extend beyond the site boundary as flow reduction impacts could extend further downstream. The spatial scale for both projects in both scenarios is therefore expected to be medium.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is medium prior to closure and low thereafter because of reduction in duration.

Probability

The probability of the alteration of drainage patterns is definite, but the magnitude of the reduced flows is unlikely to result in substantial deterioration and related flow impacts downstream therefore probability is medium until closure when it is expected to reduce to low.

Significance

The significance is high without mitigation. With mitigation this reduces to medium prior to closure and low thereafter.

Unmitigated – summary of the rated alteration of natural drainage patterns impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M	H	M	H	M	H

Mitigated – summary of the rated alteration of natural drainage patterns impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
For construction, operation and decommissioning						
Mitigated	M	M	M	M	M	M
Closure						
Mitigated	L	L	L	L	L	L

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.

Actions

Impala will comply with the terms and conditions of water authorisations/licenses.

In all phases, mine infrastructure will be constructed, operated and maintained so as to comply with the provisions of the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto. Key related issues are that:

- clean water systems are separated from dirty water systems;
- the size of dirty areas are minimised and clean run-off and rainfall water is diverted around dirty areas and back into its normal flow in the environment; and
- the location of all activities and infrastructure should be outside of the specified zones and/or flood lines of watercourses.

Emergency situations

None identified.

GROUNDWATER

7.2.9 ISSUE: CONTAMINATION OF GROUNDWATER

The information in this section was sourced from the groundwater specialist studies (Metago, September 2011, December 2011 and March 2012).

Introduction

There are a number of sources in all mine phases that have the potential to pollute groundwater. In the construction and decommissioning phases some of these potential pollution sources are temporary and diffuse in nature. Even though the sources are temporary in nature, related potential pollution can be long term. The operational phase will present more long term potential sources and the closure phase will present final land forms, such as the proposed WRD expansion at Shaft 16 that may have the potential to pollute water resources through long term seepage and/or run-off.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management	Shaft WRD General site management Maintenance and aftercare

Construction	Operational	Decommissioning	Closure
General site management Other support services and amenities Demolition Rehabilitation	General site management Other support services and amenities Rehabilitation	General site management Other support services and amenities Demolition Rehabilitation	

Rating of impacts

Severity / nature

Two types of pollution sources are broadly considered. The one type is diffuse pollution which includes ad hoc spills and discharges of polluting substances. The other type is point source pollution which includes more long term pollution associated with sources such as the proposed Shaft 16 WRD expansion and the temporary Pit8C WRD. Geochemical results indicate that there is no material risk of acid mine drainage but there is potential for groundwater contamination associated with the proposed new WRD expansion and temporary overburden and topsoil stockpiles associated with the proposed Pit8C project. This contamination has potential to influence third party boreholes and the surrounding surface water resources because of the link between ground and surface water. This is a high severity in the unmitigated scenario.

In the mitigated scenario the severity can be reduced to low because of pollution prevention and/or mitigation measures.

Duration

In the unmitigated scenario, groundwater contamination and the potential related health impacts are long term in nature, occurring for periods longer than the life of project. With mitigation the pollution and related impacts can be prevented or mitigated during the life of l the projects which reduces the duration to medium.

Spatial scale / extent

Unmitigated groundwater pollution impacts may extend beyond the proposed project boundaries. This is particularly relevant to the potential pollution from the proposed WRD expansion because experience in the Impala surface use area indicates that long term unmitigated groundwater pollution plumes may influence the water quality in downstream watercourses. This is a medium spatial scale. Although mitigated groundwater pollution impacts will be confined to the proposed project areas, the spatial scale remains medium given that the effects could still be felt beyond the site boundaries.

Consequence

The unmitigated consequence is high. With mitigation this reduces to low.

Probability

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- Does contamination reach groundwater resources?
- Will people and animals utilise this contaminated water?
- Is the contamination level harmful?

The first element is that contamination reaches the ground and surface water resources adjacent to the proposed project areas. Even with mitigation this has been observed to occur at Impala because of the influence of seepage and run-off from existing activities and infrastructure.

The second element is that third parties and/or livestock use this contaminated water for drinking purposes. There is a possibility for this to occur through the consumption of both groundwater and surface water, albeit limited in the case of human consumption, because of the fact that most of the villages surrounding the proposed project areas are provided with reticulated water and as a result there is limited use of borehole water for domestic purposes. In addition, although livestock may drink surface water when it is available this is not their constant water supply because for most of the year the watercourses are dry.

The third element is that it is likely that some contaminants will be at a level which is harmful to humans and livestock. This is cumulatively influenced by the quality of any discharged water, by the quality of the water in the receiving water resource and by the diluting effect of any rainwater particularly in the rainy season.

As a combination, the unmitigated impact probability is high and the mitigated probability is low.

Significance

The unmitigated significance of this cumulative impact is high and the mitigated significance is medium to low.

Unmitigated – summary of the rated contamination of groundwater impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H

Mitigated – summary of the rated contamination of groundwater impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	M	M	M	L	L

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to prevent pollution of groundwater resources and related harm to water users.

Actions

Impala will comply with Section 73 of Regulation 527, the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto, and the terms and conditions of water authorisations/licenses.

In the construction, operation and decommissioning phases the mine will ensure that all mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute groundwater. This will be implemented through a procedure(s) covering the following:

- pollution prevention through basic infrastructure design;
- pollution prevention through education and training of workers (permanent and temporary);
- pollution prevention through appropriate management of materials and non-mineralised waste;
- the required steps to enable containment and remediation of pollution incidents; and
- specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.

Any future infrastructure that has the potential to pollute groundwater resources will be designed and implemented in a manner that pollution is addressed in all mine phases.

Infrastructure that has the potential to cause groundwater contamination will be identified and included in a groundwater pollution management plan which will be implemented as part of the operational phase. This plan has the following principles:

- determine potential pollution sources;
- determine the extent of the existing or potential contamination plume;
- design and implement intervention measures to prevent, eliminate and/or control the pollution plume;
- monitor all existing and potential impact zones to track pollution and mitigation impacts;
- where monitoring results indicates that third party water supply has been polluted by Impala, Impala will ensure that an alternative equivalent water supply will be available.

Emergency situations

Discharge incidents that may result in pollution of groundwater resources will be handled in accordance with the Impala emergency response procedure.

7.2.10 ISSUE: DEWATERING

The information in this section was sourced from the groundwater specialist study (Metago, December 2011).

Introduction

The unlikely but possible pumping of seepage water from the Pit8C project has the potential to cause a dewatering cone, which may cause a loss in water supply to surrounding borehole users.

Activities and infrastructure - link to mine phases

Construction	Operation	Decommissioning	Closure
			N/A
Opencast mining	Opencast mining	Opencast mining	

Rating of impact

Severity / nature

If dewatering cones develop in the upper aquifer around opencast mining areas there could be a temporary loss of water to third party groundwater users if any third party boreholes are located in the impact zone. Any water loss would be a high severity in the unmitigated scenario. With mitigation the severity reduces to low.

Duration

The duration of the impacts is linked to the duration of the dewatering and the recharge time thereafter. It is expected that the duration of any dewatering impacts may extend beyond closure in the unmitigated scenario. With mitigation the impact will be short term.

Spatial scale / extent

Given the relatively small size and short duration of the Pit8C project, the spatial scale is not expected to extend much beyond the project site, even so a medium spatial scale has been conservatively assumed.

Consequence

In the unmitigated scenario the consequence is medium. With mitigation it reduces to low.

Probability

No pit inflows and associated dewatering impacts have been observed in any of the previous adjacent opencast mining operations to date. Furthermore, no third party boreholes are the located within 1.5 km of the proposed Pit8C site. Therefore, whether considered incrementally for the Pit8C site or cumulatively for the Impala surface use area, the impact probability in the unmitigated and mitigated scenario is therefore low.

Significance

In the unmitigated scenario the significance is medium. This reduces to low with mitigation.

Unmitigated – summary of the rated dewatering impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation						
Unmitigated	H	H	M	H	L	M

Mitigated – summary of the rated dewatering impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation						
Mitigated	L	L	L	L	L	L

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19)

Objective

The objective of the mitigation measures is to prevent water losses to third party water users.

Actions

All potentially affected third party boreholes will be included in the Impala ground water monitoring program to ensure that changes in water depths can be identified, where possible.

Where Impala's dewatering causes a loss of water supply to third parties an alternative equivalent water supply will be provided by Impala until such time as the dewatering impacts cease.

Emergency situations

None identified.

AIR QUALITY

7.2.11 ISSUE: AIR POLLUTION

Information in this section was sourced from the air quality specialist report (Airshed, March 2012).

Introduction

There are a number of activities/infrastructure in all phases that have the potential to pollute the air. In the construction and decommissioning phases these activities are temporary in nature. The operational phase will present more long term activities and the closure phase will present final land forms that may have the potential to pollute the air through long term wind erosion.

Air pollution related impacts on biodiversity have been discussed in Section 7.2.6 and therefore this section focuses on the potential for human health impacts.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Transport systems Non-mineralised waste management Other support services and amenities Demolition Rehabilitation	Site preparation Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Transport systems Non-mineralised waste management Other support services and amenities Rehabilitation	Site preparation Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Transport systems Non-mineralised waste management Other support services and amenities Demolition Rehabilitation	Shaft WRD Maintenance and aftercare

Rating of impact

Severity / nature

In the operational phase of both projects, the main contaminants include: inhalable particulate matter less than 10 microns in size (PM_{10}), larger total suspended particulates (TSP) that relate to dust fallout, and gas emissions mainly from vehicles. The construction and decommissioning phases will be similar. At closure there will only be potential for PM_{10} and TSP emissions. A number of specialist studies previously conducted in the Impala surface use area have concluded that vehicle and generator emissions of this nature are inconsequential and TSP emissions and fallout are predicted to marginally exceed the evaluation criteria for various scenarios, but this results mainly in nuisance impacts. The focus of this assessment is therefore on the more significant PM_{10} emissions which may have human health impacts.

When considering the surface use area and surrounds, the following points are relevant:

- When considered in isolation, the Shaft 16 WRD expansion is not associated with any significant dust generating sources in that waste rock itself is generally not mobile due to the particle size and weight. Moreover, the footprint of the expansion is already subject to land clearing and wind erosion on a seasonal basis because of the dryland sunflower cultivation that takes place on the site. If anything, the development of the WRD on this area will reduce the amount of cleared area and associated wind eroson and potential for dust pollution.
- When considered in isolation, the Pit8C project is unlikely to cause incremental impacts further than 1.5 kms from the proposed project site. Given that there are no third party communities within this radius, the incremental impacts are not considered further and the focus is more on the total cumulative impacts of the Impala operations as a whole.
- Given that both projects are effectively replacement for existing similar projects that will be decomissioned, the net contribution of the new projects is unlikely to be noticeable from the

perspective of source contributions from within the greater Impala surface use area. It follows that the assessment of the current operations at Impala would be sufficient to consider the cumulative impacts associated with the proposed projects.

- Existing monitoring data and previous specialist models indicate that there is already potential for ambient PM_{10} standards and dust fallout to be exceeded within the Impala surface use area. The assessments below will also take this into account.

In order to determine the potential for health impacts the following set (Table 43) of evaluation criteria have been used.

TABLE 43: AIR POLLUTION EVALUATION CRITERIA

Contaminant	Averaging Period	Evaluation criteria	Source
PM_{10}	Daily	Current - 120 microgram/m^3 2015 - 75 microgram/m^3	NEM: AQA – National Ambient Air Quality Standards, GN 1210, December 2009
	Annual	Current - 50 microgram/m^3 2015 - 40 microgram/m^3	

Recent modelling results (Airshed, March 2012) for all Impala sources in the unmitigated scenario indicate that cumulative ambient PM_{10} concentrations have the potential to exceed the current and/or future evaluation criteria at some of the surrounding residential areas. As a first level health impact screening exercise this indicates the potential for legal non-compliance and unacceptable human health impacts, which amounts to a high severity regardless of the contributions from the Pit8C and Shaft 16 WRD expansion projects.

The modelling results indicate further that with mitigation, the predicted PM_{10} ambient concentrations from current operations will be in compliance with the current and future evaluation criteria. Although dust fallout monitoring results indicate some exceedances of both the residential and industrial guideline from time to time, concentrations at these monitoring stations and others within the Impala surface use area are generally kept within the SANS dust fallout guideline limits. This reduces the severity to medium.

Duration

Without mitigation the duration of the health impacts could extend beyond closure. With mitigation, the duration of impacts will be limited to the phase prior to closure.

Spatial scale / extent

The spatial scale of the potential impact extends off site in both the mitigated and unmitigated scenarios.

Consequence

Without mitigation the consequence is high for all project components in all phases. With mitigation the consequence reduces to medium.

Probability

The health impact probability is linked to the probability of ambient concentrations exceeding the evaluation criteria. Given that there is potential for exceedances of the criteria, for PM_{10} in particular, the probability is high in the unmitigated scenario. With mitigation the probability reduces to medium.

Significance

Although incrementally the significance of this impact is considered to be low for each project component, the cumulative significance of this impact is high in the unmitigated scenario, reducing to medium with mitigation.

Unmitigated – summary of the rated air pollution impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H

Mitigated – summary of the rated air pollution impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M	M	M	M	M	M
Closure						
Mitigated	L	L	L	L	L	L

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to prevent air pollution health impacts.

Actions

Impala will comply with the terms and conditions of air pollution authorisations/licenses.

Impala will implement a dynamic air quality management plan that covers:

- the identification of sources (emissions inventory);
- the implementation of source based controls;
- the use of source and receptor based performance indicators and monitoring strategies;
- the use of source and receptor based mitigation measures;

- the use of internal and external auditing; and
- review and plan adjustment as required.

In the construction, operational and decommissioning phases, the following specific mitigation measures will be implemented for the main emission sources: roads, blasting, drilling, materials handling, vehicles and wind erosion. The recommended methods to achieve this are:

- limit the disturbance of land to what is absolutely necessary and in accordance with the existing mine infrastructure layout;
- Impala will apply dust suppression on unpaved roads through chemical binding agents and/or water sprays combined with vehicle speed controls;
- dust control at material handling points should be done by means of water sprays;
- rehabilitation and re-vegetation of all decommissioned areas;
- if not reprocessed, vegetate the side slopes of the existing permanent WRD and ensure concurrent rehabilitation of the expanded permanent WRD; and
- maintenance of all vehicles to achieve optimal exhaust emissions.

Emergency situations

Upset conditions and related unmitigated emission incidents are considered an emergency situation. These will be addressed in accordance with the Impala emergency response procedure.

NOISE

7.2.12 ISSUE: NOISE POLLUTION

Information in this section was sourced from the noise quality specialist study (Airshed, March 2012).

Introduction

Two types of noise are distinguished: noise disturbance and noise nuisance. The former is noise that can be registered as a discernible reading on a sound level meter and the latter, although it may not register as a discernible reading on a sound level meter, may cause nuisance because of its tonal character (eg. distant humming noises).

Potential noise impacts on biodiversity have been addressed in Section 7.2.6 and so this section will focus on the potential human related noise impacts.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
			N/A
Site preparation Earthworks Civil works Prospecting and survey	Site preparation Earthworks Civil works Prospecting and survey	Site preparation Earthworks Civil works Prospecting and survey	

Construction	Operational	Decommissioning	Closure
activities Shaft WRD Opencast mining Transport systems Demolition Rehabilitation	activities Shaft WRD Opencast mining Transport systems Rehabilitation	activities Shaft WRD Opencast mining Transport systems Demolition Rehabilitation	

Rating of impact

Severity / nature

Given that the Pit8C site is located in the vicinity of existing mining infrastructure and activities that are significant noise generators, it is expected that noise emissions from the Pit8C project when considered both incrementally and cumulatively will be result in in either no measurable change of a minor deterioration. Moreover, noise emissions in the greater Impala mine area that are currently associated with the current pits will cease and be replaced by similar emissions for Pit8C. Such planning of opencast pit operations implies that the total cumulative opencast emissions will remain largely unchanged. It follows that the severity in both the mitigated and unmitigated scenarios will be low.

Given that the noise generated by the Shaft 16 WRD expansion will in fact replace the noise currently generated by the existing WRD, and once the expansion of the WRD at Shaft 16 is operational, the current older section will no longer be used, it follows that the severity in both the mitigated and unmitigated scenarios will be low.

Duration

In both cases, noise impacts will cease after decommissioning and this translates into a medium duration.

Spatial scale / extent

By the nature of noise dispersion, noise impacts can be experienced beyond the project site which translates into a medium spatial scale.

Consequence

The unmitigated and mitigated consequence for both projects is low.

Probability

With regards to the Pit8C site, the mitigated and unmitigated probability of the predicted noise increases causing a noise related disturbance at the receptors is considered to be low. This is mostly due to the fact that the proposed project site is situated in an area of the Impala operations that already has multiple significant noise sources and the surrounding receptors are buildings and activities related to the existing Impala mine. Furthermore, the closest potential third party sensitive receptor sites (people at Luka South village) are located more than 1.5 kms away on the other side of multiple noise screening infrastructure including the procurement and office buildings, and the old tailings dam (No 1 and 2).

Although the Shaft 16 WRD is located within close proximity to Kanana (approximately 600 m), it must be noted that the expanded WRD will lie to the south-west of the existing WRD and will therefore be located further away from Kanana. In addition to this, the existing dump and the Shaft 16 infrastructure will serve as a partial screening mechanism between parts of Kanana and the expanded WRD. In this regard, the probability in both the mitigated and unmitigated scenario is expected to be low.

Significance

The mitigated and unmitigated significance is considered to be low for both the Pit8C and Shaft 16 WRD expansion projects.

Unmitigated – summary of the rated noise pollution impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Unmitigated	L	M	M	L	L	L

Mitigated – summary of the rated noise pollution impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	L	M	M	L	L	L

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to prevent unacceptable noise impacts.

Actions

All vehicles and equipment will be maintained to limit noise emissions.

All noise complaints will be documented, investigated and reasonable efforts made to address the area of concern. Options available for reducing noise impacts include but are not limited to:

- equipping noise sources with silencers; and
- construction of noise attenuation measures;

Where necessary, additional noise monitoring will be used as part of the investigatory process into noise complaints and as part of the assessment of the impact of mitigation measures.

Emergency situations

None identified.

BLASTING IMPACTS

7.2.13 ISSUE: BLASTING IMPACTS

Information in this section was sourced from the blasting study (Cambrian CC, December 2011).

Introduction

With reference to the table below, opencast mining at Pit8C could impact on people, animals and structures. Air quality impacts are discussed in Section 7.2.11 and biodiversity impacts are discussed in Section 7.2.6. These will not be re-assessed in this section.

Activities and infrastructure - link to mine phases

Construction	Operational	Decommissioning	Closure
			N/A
Earthworks Opencast mining Demolition	Earthworks Opencast mining	Earthworks Opencast mining Demolition	-

Rating of impact

Severity / nature

Injury to third parties and livestock may be caused by fly rock. Damage to third party infrastructure may be caused by fly rock, ground vibration, and/or air blast. In the unmitigated scenario, the associated severity is considered high given that damage to third parties and livestock could result in the irreplaceable loss of resources. In the mitigated scenario, this severity reduces to medium because measures can be taken to control blasts and associated impacts.

Duration

While damage to infrastructure can be repaired in the short term, injury or death is considered to be long term in nature. Therefore the unmitigated and mitigated impact duration is high.

Spatial scale / extent

Blast impacts may extend beyond the project site boundary particularly in the unmitigated scenario. In both the unmititgated and mitigated scenarios, the spatial extent is therefore medium. In considering the spatial scale associated with Pit8C, the following spatial analysis is relevant.

TABLE 44: PROXIMITY OF STRUCTURES TO THE PROPOSED OPENCAST EXPANSION PROJECT

500 m	**1 km**	**1.5 km**
Impala offices, roads, railway line, pipelines, underground workings Power line Ad-hoc grazing cattle	Impala offices, roads, railway line, pipelines, underground workings, hospital, mineral processing complex Power line Ad-hoc grazing cattle	Impala offices, roads, railway line, pipelines, underground workings, hospital, hostel, mineral processing complex Power line Ad-hoc grazing cattle

The interpretation of Table 44 requires a distinction between Impala and third party structures as well as Impala employees/contractors and third parties (including livestock). In this regard, there is multiple Impala infrastructure within the potential impact zone which implies that there will be Impala employees and contractors within this zone. This aspect is not assessed in the EIA because it requires specific attention in terms of Impala's internal Mine Health and Safety practices. The EIA does however consider that while no third party infrastructure is within this zone, there is potential for cattle, cattle-minders and road users to be impacted.

Consequence

The consequence is high in the both the unmitigated and mitigated scenarios.

Probability

The probability of injury to third parties or livestock is considered to be medium for the Pit8C project in the unmitigated scenario because although this is an uncommon occurrence, it remains a potential risk given the fact that road users, cattle and cattle-minders access the area. This can be reduced to low with the implementation of management and mitigation measures.

Significance

The significance has been rated as high in the unmitigated scenario. This can be mitigated to medium.

Unmitigated – summary of the rated blasting impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operational						
Unmitigated	H	H	M	H	M	H

Mitigated – summary of the rated blasting impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operational						
Mitigated	M	H	M	H	L	M

Conceptual description of proposed mitigation measures

Discussion of the conceptual management measures is provided below and tabulated in the EMP (Section 19).

Objectives

The objective of the management measures is to prevent harm to people, animals and structures.

Actions

Impala will implement a blast management plan which has the following key principles:

- pre mining structure and crack surveys of structures within the potential impact zone;
- design of blasts to prevent injury to people and livestock and to prevent damage to structures. As a minimum the blast design will achieve:
    - a fly rock impact zone limit that prevents harm to people, animals and structures and that is a maximum of 500 m;
    - a peak particle velocity limit of less than 12 mm/s at third party structures that are built according to building industry standards and which is further reduced at third party structures that are not built according to building industry standards; and
    - an air blast limit of less than 125dB at third party structures.
- communication of the planned blast programme to interested and affected parties;
- pre blast warning and evacuation to clear people, traffic, moveable property and livestock from the potential impact zone;
- blast monitoring to verify the effectiveness of the blast design and blast execution;
- audit and review to adjust the blast design where necessary to achieve the stated objectives;
- formal documented investigation and response for all third party blast related complaints; and
- remediation of all impacts caused by blasting.

As a general rule, no blasting will take place within 500 m of third party structures. Where Impala would like to blast in areas within this 500 m distance, a project specific risk assessment will be completed and additional project specific mitigation measures will be implemented, subject to approval by the relevant stakeholders and/or authority(ies).

Emergency situations

If a person or animal is injured by blasting activities this must be handled in accordance with the Impala emergency response procedure.

TRAFFIC

7.2.14 ISSUE: ROAD DISTURBANCE AND TRAFFIC SAFETY

Information in this section was sourced from the project team.

Introduction

Traffic impacts are expected from construction through to the end of the decommissioning phase when trucks, buses, and private vehicles make use of the private and public transport network in and adjacent to the proposed project areas. The key potential traffic related impacts are on road capacity and public safety.

Activities and infrastructure - link to mine phases

Construction	Operation	Decommissioning	Closure
			N/A
Transport systems	Transport systems	Transport systems	

Rating of impact

Severity / nature

Although the development of Pit8C will require the building of a new gravel access road, this road will form part of the existing internal Impala network and therefore it is not invisaged that road disturbance and traffic safety will be materially changed as a result thereof. From a cumulative perspective, the total traffic volume within the surface use area will not be affected by the Pit8C project as it is effectively a replacement of existing operations with no net traffic increase.

The traffic in and around the proposed Shaft 16 WRD expansion project is not expected to result in additional safety risks because these roads are already used for mine and public traffic. From a cumulative perspective, the total traffic volume within the surface use area will not be affected by the Shaft 16 WRD expansion project as it is effectively a replacement of an existing operation with no net traffic increase.

It therefore follows that the current cumulative assessment of traffic impacts within the Impala surface use area is applicable.

Existing traffic volumes (comprising both Impala and public traffic) are associated with an acceptable level of service in the context of the existing public and private road infrastructure. Notwithstanding this, the following safety risks apply:

- pedestrian accidents;
- rail crossing accidents; and
- vehicle accidents.

Traffic accidents have the potential to injure people and animals. In the unmitigated scenario the severity is high. In the mitigated scenario the severity reduces to medium because the frequency of accidents is expected to reduce.

Duration

Any serious injury or death is a long term impact in both the unmitigated and mitigated scenarios.

Spatial scale / extent

The accident sites could be located within or outside the surface use area and the indirect impacts associated with any injuries or fatalities will extend to the communities to which the injured people/animals belong. This is a medium spatial scale.

Consequence

The consequence is high in both unmitigated and mitigated scenarios.

Probability

In the unmitigated scenario the probability of traffic accidents is medium because although there are records of traffic accidents these do not occur on a continuous basis. With mitigation this reduces to low.

Significance

The unmitigated significance is high. With mitigation this reduces to medium.

Unmitigated – summary of the rated traffic impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	M	H

Mitigated – summary of the rated traffic impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M	H	M	H	L	M

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to prevent transport related accidents and/or injury to people and livestock.

Actions

In the construction, operation and decommissioning phases of the mine as a whole, Impala will implement a transport safety programme to achieve the mitigation objectives. Key components of the programme include education, training, awareness, and transport system maintenance.

Impala will facilitate communication between the North West Roads Department, municipal engineers (where relevant) and community leadership with a view to improving the safety of pedestrians on the private Impala roads. Options to consider in these discussions are:

- channelling of pedestrians to selected pedestrian crossings;
- provision of signage to create awareness of pedestrian crossings; and
- road safety education and awareness for the pedestrians.

Emergency situations

If a person or animal is injured by transport activities this must be handled in accordance with the Impala emergency response procedure.

VISUAL

7.2.15 ISSUE: VISUAL IMPACTS

Information for this section was sourced from the visual impact study (NLA, March 2011).

Introduction

Visual impacts may be caused by activities and infrastructure in all mine phases. The more significant visual impacts relate to the larger and more long term infrastructure components (particularly Shaft 16 WRD expansion) that will remain post closure.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works Prospecting and surveying activities Shaft WRD Opencast mining Power and compressed air supply Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	Site preparation Earthworks Civil works Prospecting and surveying activities Shaft WRD Opencast mining Power and compressed air supply Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation	Site preparation Earthworks Civil works Prospecting and surveying activities Shaft WRD Opencast mining Power and compressed air supply Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	Shaft WRD General site management Maintenance and aftercare

Rating of impacts

Severity / nature

The severity of visual impacts is determined by assessing the change to the visual landscape as a result of mine related infrastructure and activities.

As discussed in Section 1.1.11 the visual landscape is determined by considering: landscape character, sense of place, scenic quality, sensitivity of the visual resource and sensitive views. In this regard, the Impala surface use area has a varied visual landscape with hills and koppie in the east having high value, the plains areas to the north and middle having a moderate value and the developed areas to south and west having a low value. The proposed Pit8C and Shaft 16 WRD project sites are located in the south and west zones of low landscape value.

When considering the potential change to the visual landscape the key issues are: visual exposure, visual intrusion, and sensitivity of receptors. Each of these issues is discussed below.

Visual exposure is the extent to which infrastructure and activities will appear in the various views. It follows that the closer the infrastructure and activities, the greater the visual exposure. The visual exposure is considered to be low for both projects because of the following:

- Pit8C is situated within existing mining infrastructure and activities and adjacent to Impala stores and offices and is not near any sensitive third party receptor sites. It will therefore not be visible from any residential areas. In addition to this the visual alteration of the proposed site is temporary in nature and following operations will be rehabilitated.
- The Shaft 16 WRD expansion site is located approxiamtely 600 m from the Kanana community, however it must be noted that the proposed expansion will be south-west of the existing WRD and therefore will be partially screened from Kanana by the existing WRD and Shaft 16 infrastructure.

Visual intrusion is the extent to which the infrastructure and activities contrast with the visual landscape and can/cannot be absorbed by the landscape. In this regard, given the existing infrastructure disturbances at both sites, the visual intrusion of the new infrastructure is expected to be low.

The sensitivity of receptors relates to the way in which people will respond to the visual impacts associated with the proposed projects. In this regard, no concerns have been raised and given that the projects are located within the Impala existing infrastructure, it is unlikely that people will have sensitive visual expectations.

Taken cumulatively, the severity is considered to be low in both the mitigated and unmitigated scenarios.

Duration

In the unmitigated scenario the duration is high because the impacts will continue post closure. In the mitigated scenario the impacts for Pit8C are unlikely to extend post closure because the site will have been rehabilitated. In the case of Shaft 16 WRD expansion however, this will remain a permanent feature and so even after rehabilitation, in the mitigated scenario the duration will remain high.

Spatial scale / extent

For both project components in all phases visual impacts are likely to be localised (within site boundaries) and on this basis, the spatial scale is low.

Consequence

The unmitigated consequence is medium for both projects. With mitigation, prior to closure, this reduces to low for Pit8C and remains medium for Shaft 16 WRD expansion.

Probability

The unmitigated probability is medium for both projects. With mitigation, this reduces to low.

Significance

The unmitigated significance both projects is medium. The mitigated significance reduces to low.

Unmitigated – summary of the rated visual impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	L	H	L	M	M	M

Mitigated – summary of the rated visual impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	L	M (H for WRD)	L	L (M for WRD)	L	L
Closure						
Mitigated	L	L (H for WRD)	L	L (M for WRD)	L	L

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to limit negative visual impacts.

Actions

In the construction and operation phases the following visual mitigation techniques will be implemented:

- limit the clearing of vegetation;
- limit the emission of visual air emission plumes (dust emissions);

- the use of lighting will be limited to project requirements and measures will be implemented to limit light pollution impacts on surrounding areas; and
- on-going vegetation establishment on rehabilitated areas and the tailings dam side slopes

In the decommissioning phase Impala will implement its closure plan which involves the removal of infrastructure, and the rehabilitation and re-vegetation of cleared areas and any final landforms that will remain post closure. These final landforms should be rehabilitated in a manner that achieves both landscape functionality and limits and/or enhances the long term visual impact.

At closure, final landforms will be managed through an aftercare and maintenance programme to limit and/or enhance the long term post closure visual impacts.

Emergency situations

None identified.

HERITAGE, PALAEONTOLOGICAL AND CULTURAL RESOURCES

7.2.16 ISSUE: LOSS OF HERITAGE PALAEONTOLOGICAL AND CULTURAL RESOURCES

Information in this section was sourced from the heritage-cultural specialist study included in Appendix E (Julius Pistorius, September 2012) and the palaeontological study (WITS, April 2011).

Introduction

As the heritage and cultural study conducted for the projects did not identify any resources of significant importance, an assessment of the loss of heritage and cultural resources is not applicable.

Emergency situations

If there are any chance finds of heritage and/or cultural sites, Impala will follow its emergency response procedure.

SOCIO-ECONOMIC

In the broadest sense, all activities associated with the proposed projects will have socio-economic impacts in all phases. Some of these are considered to be positive impacts and others are considered to be negative impacts. Each impact is assessed separately below.

7.2.17 ISSUE: ECONOMIC IMPACT

Information in this section was sourced from the economic study (Strategy4Good, September 2012) included in Appendix F.

Rating of impact

Severity / nature

The projects will have a net positive impact on the provincial and national economy. Whilst the proposed Pit8C project is a direct revenue generator, the development of the Shaft 16 WRD expansion will ensure the continued operation of Shaft 16 and the resultant positive economic contribution from the mine as a whole.

Positive socio-economic impacts associated with the proposed Pit8C project relate to the extension of current employment contracts. Negative socio-economic impacts relate to the negative loss towards current land users. This pertains to the temporary loss of less than four ha of ad-hoc grazing land available for cattle.

Positive socio-economic activities associated with the proposed Shaft 16 WRD expansion includes the employment of some local community members during the construction phase. Negative socio-economic impacts relate to the negative loss towards current land users. This pertains to the loss of arable land for dryland sunflower cultivation and less than one ha of potential grazing veld.

The following are key findings from the Economic Landuse Analysis (Strategy4Good, August 2012):

- The negative economic impact of losing the current land use on 24 hectares (both project footprint areas combined) is immaterial in the context of the proposed developments;
- Very few jobs will be created for the WRD expansion (only 10 to 20 additional jobs will be created and this will be during the construction phase only);
- The Pit8C project will last approximately 12-18 months and will employ 30 people (essentially redeployment from other parts of the opencast operations). These jobs are then further dramatically reduced based on the fact that 1 job could last potentially 40 years in the agricultural industry, and the mining jobs are created for 1 year only;
- The jobs created and potentially lost is insignificant and immaterial to the regional economy. Following from this, using a GDP per employee quantum per industry, the mining income is slightly more than the potential agriculture lost and again these amounts are so small that they are immaterial to an economic land use analysis; and
- The potential loss of R240 000, (being R10 000 per hectare for agricultural land), is equally immaterial.

It follows that without mitigation the economic contribution from the proposed WRD expansion project is low positive, increasing to medium positive with mitigation. Whilst the economic benefits associated with the dryland cultivation site will be permanently lost in the unmitigated scenario, Impala and the RBA have agreed to source alternative land for the affected farmer which mitigates this issue.

The economic losses associated with grazing at the Pit8C site will only be temporarily lost in the mitigated scenario because with rehabilitation, this land use can be re-established post-closure. It follows that without mitigation, the economic impact is low positive, and with mitigation it increases to medium positive.

Duration

In the unmitigated scenario, the positive economic impacts described above will primarily be limited to the life of projects albeit that after closure, there may still be some positive impacts through maintenance and aftercare activities. Similarly, the negative land use economic impacts will continue post-closure.

With mitigation, the positive economic impacts remain the same but duration of the negative land use economic impacts reduces to medium term

Spatial scale / extent

In both the mitigated and unmitigated scenarios, the spatial scale of the impact is medium because it may extend beyond the proposed project site boundaries.

Consequence

In both the unmitigated scenario, the consequence is medium positive increasing to high positive with mitigation.

Probability

The impacts will definitely occur in both the mitigated and unmitigated scenarios.

Significance

In the unmitigated scenario, the significance of this potential impact is medium positive. In the mitigated scenario, the significance is high positive.

Unmitigated – summary of the rated economic impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	L+	H	M	M+	H	M+

Mitigated – summary of the rated economic impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M+	H	M	H+	H	H+

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to enhance the positive economic impacts and limit the negative economic impacts. Part of this objective is to enhance the contribution to the local economy in particular.

Actions

The mine as a whole will ensure that:

- it (and its contractors) hire local people from the closest communities where possible;
- it extends its formal bursary and skills development programmes to the closest communities to increase the number of local skilled people and thereby increase the potential local employee base;
- it procures local goods and services from the closest communities where possible;
- it implements a procurement mentorship programme which provides support to local business from the enquiry to project delivery stages;
- where farming land is lost to mining, the affected farmer(s) will be provided with alternative suitable land by facilitating discussions with the Royal Bafokeng Administration (RBA) and if this is not feasible alternative compensation will be provided;
- it incorporates economic considerations into its closure planning from the outset;
- that these closure planning considerations cover the skilling of employees for the downscaling, early closure and long term closure scenarios;
- that these closure planning considerations cover the needs of future farming for the downscaling, early closure and long term closure scenarios; and
- It identifies and develops sustainable business opportunities and skills, independent from mining, for members of the local communities to ensure continued economic prosperity beyond the life of mine

Emergency situations

None identified.

7.2.18 ISSUE: INWARD MIGRATION

Information in this section was sourced from the socio-economic review for Impala (Strategy4Good, June 2011) and the economic land use and sustainability study included in Appendix F (Strategy4Good, September 2012)

Introduction

However small in scale, mining projects tend to bring with them an expectation of employment in all project phases prior to closure. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns

around safety and security. This section focuses on the potential for the inward migration and associated social issues.

Rating of impact

Severity / nature

The effects of inward migration can be significant. These effects could include, but not be limited to:

- potential establishment or expansion of informal settlements;
- increased pressure on housing, water supply infrastructure, sanitation and waste management systems and infrastructure, health care and community services and infrastructure;
- potential for increased pressure on natural resources such as water, fauna, flora and soils;
- increase in crime; and
- spread of disease, most notably HIV/Aids and tuberculosis.

Given the size and scale of the projects in comparison to existing Impala operations, it is unlikely that the projects will have a noticeable incremental impact, therefore the assessment of current cumulative impacts is relevant.

It follows that in the unmitigated scenario, the mine as a whole will attract job seekers to the area, which is likely to cause an increase of people moving through the surface use area, pressure on the capacity of existing communities and possibly also the development of informal settlements. This situation can be worsened if the mine does not undertake adequate planning for employee and contractor housing and transport. In general, both increased movement of poor people into an area and informal settlements are associated with poor standards of living which can promote disease, crime and a general threat to the safety and security of an area. Linked to this influx of people is the potential inability of receiving areas to supply basic services such as water, food, electricity, health, education and sanitation.

The severity of potential impacts is high in the unmitigated scenario. With mitigation, measures can be taken to prevent the establishment of informal settlements, to limit the pressure on infrastructure and services, and to promote the on-going safety and security of the existing community.

Duration

In the normal course, social impacts associated with each phase of the project will occur for the life of the project, but negative social issues associated with inward migration can continue beyond the closure of the mine, particularly in the unmitigated scenario.

Spatial scale / extent

In both the unmitigated and mitigated scenarios, the impacts of inward migration could extend beyond the surface use area and into surrounding communities.

Consequence

In the unmitigated scenario the consequence associated with inward migration is high. In the mitigated scenario, the consequence is reduced to medium.

Probability

In the unmitigated scenario the impact is considered to be probable because this type of pressure has been experienced in the communities around Impala. With mitigation, impacts associated with inward migration are considered to be less likely, but they are unlikely to be eliminated.

Significance

In the unmitigated scenario, the significance of this potential impact is high. With mitigation this may reduce to medium.

Unmitigated – summary of the rated inward migration impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H

Mitigated – summary of the rated inward migration impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	H	M	H	M-L	H-M

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Sections 19).

Objective

The objective of the mitigation measures is to limit inward migration and related social impacts.

Actions

In terms of recruitment, procurement and training:

- good communication with all job and procurement opportunity seekers will be maintained throughout the recruitment process. The process must be seen and understood to be fair and impartial by all involved. The personnel in charge of resolving recruitment and procurement concerns must be clearly identified and accessible to potential applicants;
- the precise number of new job opportunities (permanent and temporary) and procurement opportunities will be made public together with the required skills and qualifications. The duration of temporary work will be clearly indicated and the relevant employees/contractors provided with regular reminders and revisions throughout the temporary period;
- recruitment and procurement, by Impala and its contractors, will be preferentially provided to people in the communities where possible, that are closest to Impala. In order to be in a position to achieve

this a skills register of people within the closest communities will be maintained. Impala will also preferentially provide bursaries and training to people that reside in these closest communities;

- there will be no recruitment or procurement at the gates of the mine. All recruitment will take place off site, at designated locations in the closest communities. All procurement will be through existing, established procurement and tendering processes that will include mechanisms for empowering service providers from the closest communities; and

Impala will work with its neighbours, local authorities and law enforcement officials to monitor and prevent the development of informal settlements near the mine and to assist where possible with crime prevention within the surface use area.

Impala will implement a health policy on HIV/ADS and tuberculosis. This policy will promote education, awareness and disease management both in the workplace and in the home so that the initiatives of the workplace have a positive impact on the communities from which employees are recruited. Partnerships will be formed with local and provincial authorities to maximise the off-site benefits of the policy.

Impala will work closely with the local and regional authorities, the Royal Bafokeng Administration and other mines/industry in the area to be part of the problem solving process that needs to address social service constraints.

Impala will implement a stakeholder communication, information sharing and grievance mechanism to enable all stakeholders to engage with Impala on both socio-economic and environmental issues.

Emergency situations

The establishment of any informal settlements is considered to be an emergency situation that will be handled in accordance with the Impala emergency response procedure.

LAND USE

7.2.19 ISSUE: LAND USE IMPACTS

Information in this section was sourced from on-site observations and the project team.

Introduction

There are project related activities and infrastructure that may have an impact on other land uses in the proposed project areas in all mine phases.

Activities and infrastructure - link to mine phases

Construction	Operation	Decommissioning	Closure

Construction	Operation	Decommissioning	Closure
Site preparation	Site preparation	Site preparation	Shaft WRD
Earthworks	Earthworks	Earthworks	General site management
Civil Works	Civil Works	Civil Works	Maintenance and aftercare
Prospecting and survey activities	Prospecting and survey activities	Prospecting and survey activities	
Shaft WRD	Shaft WRD	Shaft WRD	
Opencast mining	Opencast mining	Opencast mining	
Power and compressed air supply and use	Power and compressed air supply and use	Power and compressed air supply and use	
Water supply and use	Water supply and use	Water supply and use	
Transport systems	Transport systems	Transport systems	
Non-mineralised waste management	Non-mineralised waste management	Non-mineralised waste management	
General site management	General site management	General site management	
Other support services and amenities	Other support services and amenities	Other support services and amenities	
Demolition	Rehabilitation	Demolition	
Rehabilitation		Rehabilitation	

Rating of impact

Severity / nature

The proposed Pit8C project site is located on and adjacent to existing roads, Impala offices and stores facilities, with part of the site being comprised of undeveloped veld which is used for ad-hoc cattle grazing. The majority of the Shaft 16 WRD expansion site is currently utilised for dryland sunflower cultivation with a small portion of the site being comprised of vacant veld which is used for ad-hoc cattle grazing. Impala has control over the impacts it causes on its own facilities and infrastructure, therefore this assessment focuses only on the agricultural land use impacts.

Pit8C

In the unmitigated scenario, part of the project footprint will be permanently lost as an ad-hoc grazing resource. In the cumulative context of increasing development and reducing open veld, this is considered a high severity. In the mitigated scenario, following closure, the site will be rehabilitated and can be re-used for grazing. The associated temporary loss in land use is considered to be a low severity.

Shaft 16 WRD expansion

In the unmitigated scenario, the project footprint will be permanently lost as arable dryland cultivation ground and as a limited ad-hoc grazing resource. In the cumulative context of increasing development and reducing open veld, this is considered a high severity. In the mitigated scenario, alternative land will be made available to the affected farmer which reduces the severity to low.

Duration

In the unmitigated scenario the impact on land use will extend beyond mine closure. This is a long term duration. With mitigation the duration reduces to medium.

Spatial scale / extent

The spatial scale is limited to the project footprint area for both projects and is therefore considered to be low.

Consequence

The unmitigated consequence is high in all project phases for both the Pit8C and Shaft 16 WRD expansion projects. The mitigated consequence reduces to low for Pit8C and remains high for Shaft 16 WRD expansion.

Probability

In the unmitigated scenario, where environmental and social impacts are uncontrolled, the probability that land uses will be impacted bythe proposed projects is definite. With mitigation, the probability reduces to low.

Significance

The unmitigated significance is high for both projects but with mitigation this reduces to low.

Unmitigated – summary of the rated land use impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M	H	L	M	H	H

Mitigated – summary of the rated land use impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	M	L	L	L	L

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to prevent unacceptable negative impacts on surrounding land uses.

Actions

Impala will implement the EMP commitments with a view not only to prevent and/or mitigate the various environmental and social impacts, but also to prevent negative impacts on surrounding land uses.

The affected crop farmer at the Shaft 16 WRD expansion site will be provided with alternative land of equivalent capability.

Rehabilitation of the Pit8C site wil focus on re-establishing grazing potential as soon as possible after decommissioning.

Closure planning will incorporate measures to achieve the future land use plans for the land within the Impala surface use area.

Emergency situations

None identified.

7.3 DEFINITION OF CRITERIA USED

Both the criteria used to assess the impacts and the method of determining the significance of the impacts is outlined in Table 45. This method complies with the method provided in the EIA guideline document. Part A provides the approach for determining impact consequence (combining severity / nature, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D. Unmitigated scenario is considered for each impact

7.4 PHASES AND TIMEFRAMES OF POTENTIAL IMPACTS

An indication of the phases in which impacts could occur is included in Section 7.2. This section also provides an indication of the duration of potential impacts. Potential impacts associated with the project have the potential to occur in almost all project phases and on a continuous basis if unmitigated. With the implementation of the mitigation as presented in Section 19 and Appendix A, the monitoring programmes as presented in Section 21 and the emergency response procedures as presented in Section 20 the timeframe of potential impacts will be reduced significantly.

TABLE 45: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of severity / nature, spatial extent and duration**
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action. Irreplaceable loss of resources.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints. Noticeable loss of resources.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints. Limited loss of resources.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE/ EXTENT of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national

PART B: DETERMINING CONSEQUENCE					
SEVERITY / NATURE = L					
DURATION	Long term	**H**	**Medium**	**Medium**	**Medium**
	Medium term	**M**	**Low**	**Low**	**Medium**
	Short term	**L**	**Low**	**Low**	**Medium**
SEVERITY / NATURE = M					
DURATION	Long term	**H**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**
SEVERITY / NATURE = H					
DURATION	Long term	**H**	**High**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Medium**	**Medium**	**High**
			L	**M**	**H**
			SPATIAL SCALE / EXTENT		

PART C: DETERMINING SIGNIFICANCE					
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**H**	**Medium**	**Medium**	**High**
	Possible/ frequent	**M**	**Medium**	**Medium**	**High**
	Unlikely/ seldom	**L**	**Low**	**Low**	**Medium**
			L	**M**	**H**
			CONSEQUENCE		

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
High	It would influence the decision regardless of any possible mitigation.
Medium	It should have an influence on the decision unless it is mitigated.
Low	It will not have an influence on the decision.

***H = high, M= medium and L= low and + denotes a positive impact.**

8 COMPARATIVE LAND USE ASSESSMENT

8.1 ALTERNATIVE LAND USES WHICH COULD BE IMPACTED ON

The alternative land uses that could be affected have been described and assessed in Section 7.2.19. These include:

- Ad-hoc grazing, wood harvesting, roads, railway, pipelines, powerlines, offices, stores and other buildings are the existing land uses in the footprint of the proposed Pit8C project. The rest of the surrounding areas are dominated by mining infrastructure and activities that are currently in place and that will continue into the foreseeable future.
- Dryland sunflower cultivation and ad-hoc grazing are the existing and proposed land uses in the footprint of the proposed Shaft 16 WRD area. The rest of the surrounding areas are dominated by mining infrastructure and activities that are currently in place and that will continue into the foreseeable future.

8.2 RESULTS OF SPECIALIST COMPARATIVE LAND USE ASSESSMENT

The specialist study conducted by Strategy4Good (September 2012) is included in Appendix F. The study concludes that the mining related developments (Pit8C and shaft 16 WRD expansion) are the best land use alternatives. In the first place, the socio-economic valued added by these projects is more than the opportunity cost of the current land uses that would be lost. In the second place, in the mitigated scenario, the third party land uses at both project sites can be re-established. In the case of Pit8C, the site can be rehabilitated back to grazing potential and in the case of the Shaft 16 WRD expansion, alternative equivalent land can be provided.

9 LIST OF SIGNIFICANT IMPACTS

A list of significant impacts, when considered without mitigation, as identified in the assessment conducted in Section 7 is provided below.

- Loss and sterilisation of a mineral resource (Pit8C only)
- Hazardous excavations and infrastructure (both projects)
- Loss of soil resources and land capability through pollution (both projects)
- Loss of soil resources and land capability through physical disturbance (both projects)
- Physical disturbance of biodiversity (both projects)
- General disturbance of biodiversity (both projects)
- Pollution of surface water resources(both projects)
- Alteration of natural drainage patterns (both projects)
- Contamination of groundwater (both projects)
- Dewatering (Pit8C only)
- Air pollution (both projects)
- Blasting damage (Pit8C only)
- Road disturbance and traffic safety (both projects)
- Visual impacts (both projects
- Economic impact (both projects)
- Inward migration impact (both projects)
- Land use impacts (both projects)

10 STAKEHOLDER ENGAGEMENT PROCESS

This section provides a description of the engagement process with interested and affected persons (IAPs) followed during the course of the environmental assessment process. It outlines how IAPs were identified, confirms the details of the engagement process (with supporting documentation included as appendices), and indicates how issues raised have been addressed.

10.1 IDENTIFICATION OF INTERESTED AND AFFECTED PARTIES

The stakeholder engagement process commenced with a stakeholder analysis that was aimed at identifying parties to be involved during the environmental assessment process and associated communication structures. This was done through a deeds search of the relevant properties within the project site and immediately adjacent portions of land, social scans conducted during the stakeholder engagement process for other Impala projects, including site visits in the surrounding areas, networking and direct discussions with IAPs. Key stakeholders identified for the project include:

IAPs

- landowners (including RBA) and communities on and surrounding the project sites;
- mines and industries surrounding the Impala mine lease area; and
- non-government organisations and associations.

Regulatory authorities

- Department of Mineral Resources (DMR);
- Department of Economic Development, Environment, Conservation and Tourism (DEDECT);
- Department of Water Affairs (DWA);
- Department of Rural Development and Land Reform (DRDLR);
- South Africa Heritage Resource Agency (SAHRA); and
- Department of Agriculture, Forestry and Fishery (DAFF).

Local authorities

- Bojanala Platinum District Municipality (BPDM); and
- Rustenburg Local Municipality including relevant ward councillors (wards 4, 23, 24 and 38).

A full list of landowner names, local communities, other IAPs and non-government organisations consulted is provided in the IAPs and regulatory authorities' database included in Appendix B. The database is updated on an ongoing basis throughout the environmental process.

10.2 DETAILS OF ENGAGEMENT PROCESS

Stakeholder engagement is an integral component of any development process. The goal of stakeholder engagement is to facilitate and improve communication between stakeholders (including the applicant) in the interest of facilitating better decision-making and more sustainable development (DEAT, 2002). In accordance with the requirement of Chapter 6 of the EIA Regulations, 2006, a stakeholder engagement programme has been developed to set out a coordinated process through which IAPs are informed of the proposed development and environmental assessment process and provided with an opportunity to provide input into the project plan, the assessment and proposed mitigation measures. By consulting with authorities and IAPs, the range of environmental issues to be considered in the EIA has been given specific context and focus. Included below is an outline of the process followed, and the people engaged. Refer to Section 10.3 for a list of issues that were identified during the engagement process.

10.2.1 STEPS IN THE PUBLIC PARTICIPATION PROCESS

Steps in the process that have been conducted to date are set out in Table 46 below.

TABLE 46: CONSULTATION PROCESS WITH IAPS AND AUTHORITIES

Task	Description	Date
Notification - regulatory authorities and IAPs		
Notification of DMR and applications to DEDECT and DWA	Pre-application meetings were held with both the DMR and DEDECT on 23 July 2012. Formal application was submitted by SLR to DEDECT on 26 July 2012. A WUL amendment was submitted to the DWA by Impala on 2 July 2012. A copy of the relevant parts of the application and the responses are attached in Appendix A and Section 10.3 respectively. A formal letter of commencement was also submitted to the DMR on 3 August.	July to August 2012
Notification of the land claims commissioner	The land claims commissioner was consulted in order to verify if any land claims had been lodged on any of the proposed farms. Refer to Appendix A for a copy of the response received from the land claims commissioner.	November 2011
Social scan	A social scan of the Impala project sites was conducted by SLR. The purpose of this social scan was: • to identify relevant municipal ward councillors, landowners, land occupiers, and other interested and affected parties; • to obtain contact details for IAPs; • to identify appropriate communication structures; and • to inform IAPs of the project, upcoming public consultation process and associated scoping and EIA/EMP amendment processes. In addition to the social scan, direct consultation with landowners took place through informal discussions, focussed meetings and/or telephonic	July to August 2012

Task	Description	Date
	discussions. Issues raised during these consultations have been included in the issues table. One output of these consultations is an IAP database (Appendix B). The IAP database will be updated as required.	
Distribution of letter of intent as a background information document (BID)	A letter of intent (similar to a BID) was produced and distributed to the RBA, relevant ward councillors for Luka South and Kanana (ward 4, 23, 24 and 38), regulatory authorities as well as dryland sunflower farmer at Shaft 16 WRD expansion site, Mr Basi Ntsimane. The purpose of the letter of intent was to inform IAPs and authorities about the project, the environmental assessment process, possible environmental impacts and means of inputting into the environmental assessment process. Included in the letter of intent were details of the relevant contact person at SLR should IAPs want an additional opportunity to submit their names, contact details and comments on the project.	July to August 2012
Site notices	Laminated A1 site notices (in English and Tswana) were placed at key conspicuous positions in and around the project sites. A copy of the site notice as well as photos of the placement of these notices is attached in Appendix C.	August 2012
Newspaper advertisements	Block advertisements were placed in the Rustenburg Herald and Patinum Weekly. Refer to Appendix C for a copy of the above mentioned advertisements.	August 2012
Focused scoping meetings		
Information-sharing focused scoping meeting(s)	Focused scoping meetings were conducted with the following stakeholder groups: • Royal Bafokeng mining committee – 31 July • Future Forum (including relevant councillors) – 17 August • Basi Ntsimane (sunflower farmer at Shaft 16 WRD expansion site) – 27 August The purpose of the meetings were to provide IAPs with an outline of the project and environmental assessment process, provide information of the baseline environment, identify potential issues to be investigated further, provide input into the terms of reference for specialist studies and agree on the way forward. Minutes of the meetings are included in Appendix C.	July to August 2012
Regulatory authority scoping meeting	Regulatory authority meetings will be held once requested.The purpose of the meetings will be to provide regulatory authorities with an outline of the project and environmental assessment process, obtain input into the legal process being followed, identify potential issues to be investigated further, provide input into the terms of reference for specialist studies and agree on the way forward.	October /November 2012

Task	Description	Date
	Minutes of the meeting have been included in Appendix C	
Review of scoping report		
Public review of scoping report	Copies of the scoping report were made available for public review at the Impala Stakeholder Department, Rustenburg Library, Rustenburg Municipality, Royal Bafokeng Administration Offices, and the Future Forum (representative structures of potentially affected communities) on the 13th September 2012.	September 2012
Regulatory authority review of scoping report	Copies of the scoping report were made available for review to the DMR, DWA, DAFF, DRDLR, SAHRA, North west Eco Forum, Bojanala Platinum District Municipality and the Rustenburg Local Municipality on the 13th September 2012.	September 2012
Review of EIA/EMP		
Public review of the EIA/EMP amendment report	Copies of the EIA/EMP amendment report will be made available for public review as outlined in Section 10.2.3	October 2012
Feedback meetings with RBA mining committee and Future Forum	The purpose of the feedback meetings will be to provide the RBA and Future Forum with the opportunity to submit final comments and raise final questions/issues.	October 2012
Regulatory authority review of the EIA/EMP amendment report	Copies of the EIA/ EMP amendment report will be made available for review as outlined in Section 10.2.4. Individual meetings will be held with the key regulatory authorities to assist with the review of the EIA/EMP amendment report.	October 2012

10.2.2 SPECIALIST INPUT

Given that the proposed projects are within the existing Impala surface use area, a significant amout of specialist information exists, therefore use was made of existing applicable specialist reports, a project specific heritage/cultural study by Julius Pistorius and a socio-economic study by Strategy4Good. Details are provided in the specialist reports included as appendices.

10.2.3 REVIEW OF EIA/EMP AMENDMENT REPORT BY IAPS

Copies of the EIA/EMP report will be made available for public review as follows:

- Impala Platinum Limited (Impala Stakeholder Department)
- SLR Library (Johannesburg office)
- Rustenburg Library
- Rustenburg Municipality
- Royal Bafokeng Administration Offices
- Future Forum representative structures of the following communities via the Royal Bafokeng Administration:
    - Luka South
    - Kanana

Electronic copies of the EIA/EMP amendment report will be made available to IAPs on request (electronically by e-mail or on disk). A summary of the EIA/EMP amendment report (in English and/or Tswana) will be compiled and distributed to all IAPs registered on the project's public involvement database by hand, post and/or e-mail. IAPs will be notified of the availability of the EIA/EMP amendment report/summary for review as well as review periods via newsletter and through established community leadership and representative structures. IAPs will be given 30 days to review the EIA/EMP amendment report and submit comments in writing to SLR.

10.2.4 REVIEW OF THE EIA/EMP AMENDMENT REPORT BY REGULATORY AUTHORITIES

The EIA/EMP amendment report will be distributed to the DMR and other regulatory authorities for review as follows:

- a copy of the EIA/EMP amendment report will be forwarded to the following regulatory and local authorities: DWA, SAHRA, DAFF, DRDLR, Rustenburg Local Municipality and Bojanala Platinum District Municipality;
- Six copies and a CD of the EIA/EMP amendment report will be submitted to the DMR who will distribute to other regulatory authorities as required;

10.3 MANNER IN WHICH ISSUES RAISED WERE ADDRESSED

Stakeholder meetings and public review of the scoping reports provided IAPs with an opportunity to comment on the baseline environment and potential impacts of the project (including social and cultural impacts). **All views, issues and concerns raised have been captured into the comments and response report (Appendix D).** The comments and response report provides responses to issues raised and identifies where the issues have been addressed in the EIA and EMP report.

11 ADEQUACY OF PREDICTIVE METHODS AND ASSUMPTIONS AND UNCERTAINTIES

Assumptions, uncertainties and limitations have been discussed throughout the EIA report and in the various specialist studies. The more significant of these are included below.

11.1 ENVIRONMENTAL ASSESSMENT LIMIT

The EIA focused on third parties only and did not assess health and safety impacts on workers because the assumption was made that these aspects are separately regulated by health and safety legislation, policies and standards, and that Impala will adhere to these.

11.2 PREDICTIVE MODELS IN GENERAL

None

11.3 GEOLOGY

None

11.4 CLIMATE

None

11.5 TOPOGRAPHY

None

11.6 LAND USE

None

11.7 SOILS

None

11.8 LAND CAPABILITY

None

11.9 BIODIVERSITY

None

11.10 SURFACE WATER

The bulk of the water monitoring results utilised in this report were sourced from Impala's internal database. Most of this data is generated internally by Impala.

11.11 GROUNDWATER

The bulk of the water monitoring results utilised in this report were sourced from Impala's internal database. Most of this data is generated internally by Impala.

11.12 AIR

None.

11.13 HERITAGE AND CULTURAL RESOURCES

It is possible that some heritage and cultural resources in the less developed part of the surface use area have not been discovered and/or recorded. If any new heritage and cultural resources are exposed Impala's chance find procedure will be implemented.

11.14 NOISE

None.

11.15 BLASTING

None.

11.16 VISUAL

None.

11.17 SOCIO-ECONOMIC

Information collected was only done through a desktop study. In addition to this detailed community information was obtained from the SA Household Survey on 2001 and projected to 2009 using available

data on a wider Municipal level; thus community demographic information have been forecasted to 2009 and no house-to-house surveys were undertaken.

11.18 CLOSURE COST

Assumptions relevant to the closure cost calculations are included in the costing report that is included in Appendix G.

12 ARRANGEMENT FOR MONITORING AND MANAGEMENT OF IMPACTS

This section describes the arrangements for monitoring and management of environmental impacts. It identifies the impacts that require monitoring programmes and outlines the functional requirements, roles and responsibilities and timeframes for the monitoring programmes. Further detail on each monitoring programme is included in Section 19.

12.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES

Impacts that require monitoring include:

- Hazardous excavations and infrastructures
- Physical destruction and general disturbance of biodiversity
- Pollution of surface water resources
- Contamination of groundwater
- Increase in air pollution
- Increase in noise levels
- Blasting damage
- Traffic increase and road use

In addition to the above, the commitments as included in Section 19 will require monitoring to a) ensure that they are being implemented and b) that they are effective in mitigating potential impacts on the environment, socio-economic conditions of third parties and heritage/cultural aspects. This will be done through regular internal auditing by mine personnel.

12.2 FUNCTIONAL REQUIREMENTS OF MONITORING PROGRAMMES

The purpose of the monitoring programmes is to review the mine's impact on various aspects of the environment and to report on changes needed to the management programme.

As a general approach, the mine will ensure that the monitoring programmes comprise the following:

- a formal procedure;
- appropriately calibrated equipment;
- where samples require analysis they will be preserved according to laboratory specifications;
- an independent, accredited laboratory will undertake sample analyses and/or internal laboratory results will periodically be checked by independent and accredited laboratories;
- parameters to be monitored will be identified in consultation with a specialist in the field and/or the relevant authority;
- if necessary, following the initial monitoring results, certain parameters may be removed from the monitoring programme in consultation with a specialist and/or the relevant authority;

- monitoring data will be stored;
- data will be interpreted and reports on trends in the data will be compiled; and
- both the data and the reports will be kept on record for the life of mine.

12.3 ROLES AND RESPONSIBILITIES

The roles and responsibilities for the execution of the monitoring programmes are defined below.

- Senior Operational Manager and Environmental Department Manager:
  - ensure that the monitoring programmes are scoped and included in the annual mine budget;
  - identify and appoint appropriately qualified specialists/engineers to undertake the programmes; and
  - appoint specialists in a timeous manner to ensure work can be carried out to acceptable standards.

12.4 TIMEFRAMES FOR MONITORING AND REPORTING

The timeframes for monitoring and reporting thereof are detailed in the monitoring programme (see Section 21). A summary is provided below:

Programme	**Monitoring: Timeframe and frequency**	**Reporting**
Waste rock dumps	All project phases As determined by the hazard rating in terms of the MPRDA	As determined by the hazard rating in terms of the MPRDA
Biodiversity	All project phases	As required by specialist
Groundwater and surface water	All project phases As per requirements of water use license	As per requirements of water license
Air	All project phases As per requirements of the Atmospheric Emissions Licence	As per requirements of the Atmospheric Emissions Licence
Noise	As required (dependant on stakeholder complaints)	As required
Blasting	Every surface blast	Monthly by specialist
Traffic aspects	As required (dependant on stakeholder complaints)	As required
Internal auditing	From start of construction to end of closure	As required

Programme	**Monitoring: Timeframe and frequency**	**Reporting**
	On-going	
External auditing	From start of construction to end of closure Every two years	Every two years to DMR

13 TECHNICAL SUPPORTING INFORMATION

The following specialist studies are recent studies that did not form part of any of the previously approved individual Impala EIA/EMP reports. The other specific studies have been referenced in this report but not attached to this report because they have been previously attached to other Impala EIA/EMP reports (see reference list in Section 28):

- Heritage Impact Assessment (Appendix E)
- Economic Land Use and Sustainability Analysis (Appendix F)
- Financial Provision (Appendix G)

SECTION 2 – ENVIRONMENTAL MANAGEMENT PROGRAMME

14 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR CLOSURE

14.1 ENVIRONMENTAL ASPECTS THAT DESCRIBE THE PRE-MINING ENVIRONMENT

Environmental aspects that describe the pre-mining environment as informed by the baseline description (Section 1.1) are listed below. This list serves to guide the setting of environmental objectives for mine closure.

- relatively flat topography;
- pre-mining soils supported arable, grazing and wilderness land capabilities and/or uses. Closure objectives around land capability and use must be informed by consensus with relevant stakeholders;
- a functioning ecosystem;
- preferential stormwater flowpaths;
- moderate to good groundwater quality;
- stable water table providing groundwater as a water supply source; and
- quite rural/urban environment.

14.2 MEASURES TO CONTROL OR REMEDY ANY CAUSES OF POLLUTION OR DEGRADATION

Measures required to contain or remedy any causes of pollution or degradation or migration of pollutants, both for closure of the mine and post-closure are listed below.

- Implement a waste management procedure for general and hazardous waste on site
- Ensure immediate clean-up of any spills as per the emergency response procedures (Section 20)
- Establish and maintain dirty stormwater control measures in line with regulatory requirements, until such time as potentially polluting areas are rehabilitated
- Contain pollutants at source by storing and handling potentially polluting substances on impermeable substrates, within bunded areas and with the capacity to contain spills
- Design, construct and/or operate existing and future waste dumps with runoff control measures
- Rehabilitate the site in line with a detailed closure plan to be developed at least five years prior to decommissioning

Further detail on the proposed action plans and mitigation measures is included in Section 19.

15 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR MANAGEMENT OF IDENTIFIED ENVIRONMENTAL IMPACTS

The environmental objectives and specific goals for the management of identified environmental impacts are detailed in this section.

15.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES

Impacts that require monitoring include:

- Hazardous excavations and structures
- Physical destruction and general disturbance of biodiversity
- Pollution of surface water resources
- Contamination of groundwater
- Increase in air pollution
- Increase in noise levels
- Blasting damage
- Traffic increase and road use

15.2 ACTIVITIES AND INFRASTRUCTURE

The source activities of potential impacts which require management are detailed in Section 2.3 and listed below.

- Site preparation
- Earthworks
- Civil works
- Prospecting and survey activities
- Shaft WRD
- Opencast mining
- Power and compressed air supply and use
- Water supply and use
- Transport systems
- Non-mineralised waste management
- General site management
- Other support services and amenities
- Demolition
- Rehabilitation
- Maintenance and aftercare

15.3 MANAGEMENT ACTIVITIES

Management activities which will be conducted to control the project actions, activities or processes which have the potential to pollute or result in environmental degradation are detailed in Section 19.

15.4 ROLES AND RESPONSIBILITIES

The key personnel to ensure compliance to this EMP report will be the operations executive, the environmental department manager and the stakeholder engagement manager. As a minimum, these roles as they relate to the implementation of monitoring programmes and management activities will include:

- Senior Operational Manager and Environmental Department Manager
  - ensure that the monitoring programmes and audits are scoped and included in the annual mine budget
  - identify and appoint appropriately qualified specialists/engineers to undertake the programmes
  - appoint specialists in a timeously manner to ensure work can be carried out to acceptable standards
- Stakeholder engagement department:
  - liaise with the relevant structures in terms of the commitments in the SLP
  - ensure that commitments in the SLP are developed and implemented timeously
  - establish and maintain good working relations with surrounding communities and landowners
  - facilitate stakeholder communication, information sharing and grievance mechanism

16 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR SOCIO-ECONOMIC CONDITIONS

16.1 ASPECTS OF THE SOCIO-ECONOMIC CONDITIONS

The socio-economic conditions surrounding the proposed project sites are described in Section 1.3.3.

16.2 OBJECTIVES AND GOALS

Specific environmental objectives and goals to control, remedy or stop potential impacts emanating from the proposed projects which may impact on communities and IAPs are described below. The information is presented in tabular format (Table 47).

TABLE 47: ENVIRONMENTAL OBJECTIVES AND GOALS – SOCIO-ECONOMIC CONDITIONS

Aspect	Environmental objective	Goals
Land uses	To prevent unacceptable impacts on surrounding land uses and their economic activity	To co-exist with existing land uses To negatively impact existing land uses as little as possible
Blasting	To minimise the potential for third party damage and/or loss	To protect third party property from proposed project-related activities, where possible Where damage is unavoidable, to work together with the third parties to achieve a favourable outcome To ensure public safety
Traffic	To reduce the potential for safety and vehicle related impacts on road users	To ensure the mine's use of public roads is done in a responsible manner
Socio-economic	To enhance the positive economic impacts and limit the negative economic impacts	To work together with existing structures and organisations
Informal settlements	To limit the impacts associated with inward migration	To establish and maintain a good working relationship with surrounding communities, local authorities and land owners
Evacuation	To prevent the potential of third party harm and injury	To protect third parties and property from harm and injury as a result of the proposed project-related activities To ensure public safety

17 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR HISTORICAL AND CULTURAL ASPECTS

No heritage/cultural resources were identified within the proposed project areas and as such no specific goals and objective are required.

18 APPROPRIATE TECHNICAL AND MANAGEMENT OPTIONS CHOSEN FOR EACH IMPACT

18.1 PROJECT ACTIONS, ACTIVITIES AND PROCESSES

All activities associated with the proposed projects have the potential to cause pollution or environmental degradation. These are described in Section 2 of this EIA and EMP report.

18.2 TECHNICAL AND MANAGEMENT OPTIONS

Appropriate technical and management options chosen to modify, remedy, control or stop any action, activity or process associated with the proposed projects which will cause significant impacts on the environment, socio-economic conditions and historical and cultural aspects are listed in the table below (Table 48) and described in detail in Section 7. In addition to these, the mine will implement an environmental management system to assist in the implementing and monitoring of commitments included in this EIA and EMP report.

TABLE 48: TECHNICAL AND MANAGEMENT OPTIONS

Potential impact	Technical and management options
Loss and sterilisation of mineral resources	Mine workings well be developed and designed taking cognisance of potential ore reserves Extraction of all possible minerals prior to final disposal
Hazardous excavations and infrastructure	Construction of berms, fencing, barriers and access control Warning signs Sealing and backfilling shafts and pits Implement monitoring programme Implement an emergency response procedure
Loss of soil resources and land capability through pollution	Implement hazardous waste, dirty water and mineralised and non-mineralised waste management procedures Permanent infrastructure designs to take long term soil prevention, land function and confirmatory monitoring into account
Loss of soil and land capability through physical disturbance	Implementation of a soil management plan Limiting disturbance of soil to what is necessary Stripping, storing, maintenance and replacement of topsoil in accordance with soil management procedures
Physical destruction of biodiversity	Implementation of the biodiversity management plan Restrict project footprint Limit disturbance on high biodiversity areas Investigation of a biodiversity offset if required Implementation of monitoring programmes Rehabilitate disturbed areas
General disturbance of biodiversity	Prevention of the killing of animal species Implementation of dust control measures Pollution prevention measures Prevention of the disturbance of ecosystems

Potential impact	Technical and management options
Pollution of surface water resources	Appropriate design of polluting facilities and pollution prevention facilities (by qualified person) Implement and maintain storm water controls that meet regulatory requirements Implement site-specific soil management plan Implement a monitoring programme (water use, process water quality, rainfall-related discharge quality) Implement emergency response procedure Implementation and maintenance of licence requirements
Alteration of natural drainage lines	Implement and maintain storm water controls that meet regulatory requirements
Contamination of groundwater	Appropriate design of pollution facilities Correct handling of hazardous wastes, mineralised and non-mineralised wastes Compensation for loss Implement and maintain terms and conditions of regulatory requirements Implementation of a monitoring programme Implement emergency response procedure Implementation and maintenance of licence requirements
Dewatering	Compensation for loss Implementation of monitoring programme
Air pollution	Implementation of air quality management plan Implementation an air quality monitoring programme Control dust plumes Implementation of an air complaints procedure Maintenance of abatement equipment Implement an emergency response procedure Implementation and maintenance of licence requirements
Noise pollution	Maintenance of vehicles and equipment Implementation of a noise complaints procedure Reducing operational hours Educate workers Equip machinery with silencers Construction of noise attenuation measures
Blasting damage	Implementation of a blast management plan Pre-mining crack survey Communication of planned blasting times with stakeholders Pre-blast warning Monitoring blasts Audit and review to adjust blast design were necessary Investigate blast related complaints Rectify damage to third party structures Implementation of a blasting complaints procedure Implement emergency response procedure Implement an evacuation plan
Traffic increase	Implementation of a traffic safety programme Education and awareness training of workers Use of pedestrian crossing by pedestrians and school children Placement of signage to create awareness Maintenance of the transport systems Implementation of a traffic complaints procedure Implement emergency response procedure

Potential impact	Technical and management options
Visual impacts	Limit the clearing of vegetation Limit the emission of visual air plumes Use of screening berms Concurrent rehabilitation Painting infrastructure to compliment the surrounding environment where possible Implementation of a closure plan Management through care and aftercare
Heritage and cultural	Limit project infrastructure, activities and related disturbances to demarcated areas as per the consolidation Project specific heritage studies will be conducted to identify any resources should the project footprint change Education of workers Exhumation and relocation of graves where required Implement emergency response procedure
Economic impact	Hire people from closest communities To extend the formal bursary and skills development to closest communities Implement a procurement mentorship programme Local procurement of goods and services Compensation for loss of land use Closure planning to make consideration for skills, economic consideration and the needs of future farming
Inward migration	Good communication in terms of recruitment, procurement and training Number of temporary and permanent new job opportunities and procurement will be made public Employment and procurement opportunities provided to closest communities No recruitment at the mine gate Notify unsuccessful job seekers Accommodation allocation to employees and contractors Maintaining an environmental profile Monitor and prevent the development of informal settlements through the interaction with neighbours, local authorities and law enforcement officials Implement a health policy on HIV/AIDs and tuberculosis to promote awareness and training Addressing social service constraints and social problems relating to education, health, water supply, solid waste management, sanitation and housing Implement emergency response procedure
Land use	Implementation of EMP commitments that focus on environmental and social impacts Take necessary steps to prevent negative impact on surrounding land Closure planning to incorporate measures to achieve future land use plans

19 ACTION PLANS TO ACHIEVE OBJECTIVES AND GOALS

Action plans to achieve the objectives and goals set out in Section 15 (bio-physical environment), Section 16 (socio-economic conditions) and Section 17 (historical and cultural) above, are listed in tabular format together with timeframes for each action. The action plans include the timeframes and frequency for implementing the mitigation measures as well identifies the responsible party.

Action plans as described below, include technical and management options for all existing operations currently being undertaken at Impala, as well as any new technical and management options that are not currently in place but are however relevant to the proposed projects.

TABLE 49: ACTION PLAN – LOSS AND STERILISATION OF MINERAL RESOURCES

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Opencast mining Shaft WRD	M	L	• Impala will continue to incorporate cross discipline planning structures for all new mining and infrastructure developments to avoid mineral sterilisation. A key component of the cross cutting function is the Mine resource manager	At start of phase	Once off	Mine resource manager
Operation	Opencast mining Shaft WRD	M	L	• Mine workings will be developed and designed so as not to limit the potential to exploit deeper minerals	On-going	On-going	Mine resource manager
Decommissioning	Opencast mining Shaft WRD	M	L	• Provision will be made to extract all minerals possible prior to final disposal onto the mineralised waste facilities. This requires additional extraction processes downstream of the UG2 and Central Concentrators in particular. Where inefficient processing or lack of technological processes has caused minerals to be disposed onto the mineralised waste facilities, the option of reprocessing the mineralised waste facilities will be considered and implemented where feasible and technologicall ypossible.	On-going	On-going	Mine Resource manager
Closure	Shaft WRD	M	L				

TABLE 50: ACTION PLAN – HAZARDOUS EXCAVATIONS AND INFRASTRUCTURE

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Demolition Rehabilitation	H	M	• All existing and proposed mineralised waste facilities and water dams will be designed and constructed in a manner to ensure stability and related safety risks to third parties and animals are addressed. It will furthermore be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer.	On-going	On-going	Professional engineer
				• Impala will survey its surface use area and update its surface use area map on a routine basis to ensure that the position and extent of all potential hazardous excavations, hazardous infrastructure and subsidence is known. It will further more ensure that appropriate management measures are taken to address the related safety risks to third parties and animals	On-going	On-going	Senior Operational Manager
				• The safety risks associated with identified hazardous excavations, subsidence and infrastructure will be addressed through one or more of the following: o Fencing, berms, barriers and/or security personnel to prevent unauthorized access;	As required	Once off	Senior Operational Manager

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				○ warning signs in the appropriate languages (s) Warning pictures can be used as an alternative			
				• Where Impala has caused injury or death to third parties and/or animals, appropriate compensation will be provided	On-going	On-going	Senior Operational Manager
				• In case of injury or death due to hazardous excavations, the emergency response procedure in Section 20 will be followed.	On-going	On-going	Senior Operational Manager
Operation	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Rehabilitation	H	M	• All existing and proposed mineralised waste facilities and water dams will be operated in a manner to ensure stability and related safety risks to third parties and animals are addressed. It will furthermore be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer.	On-going	On-going	Professional engineer
				• Impala will survey its surface use area and update its surface use area map on a routine basis to ensure that the position and extent of all potential hazardous excavations, hazardous infrastructure and subsidence is known. It will further more ensure that appropriate management measures are taken to address the related safety risks to third parties and animals	On-going	On-going	Senior Operational Manager
				• The safety risks associated with identified hazardous excavations, subsidence and infrastructure will be addressed through one or more of the following: ○ Fencing, berms, barriers and/or security personnel to prevent unauthorized access; ○ warning signs in the appropriate languages (s) Warning pictures can be used as an alternative	On-going	On-going	Senior Operational Manager
				• Where Impala has caused injury or death to third parties and/or animals, appropriate compensation will be provided	As required	As required	Senior Operational Manager
				• In case of injury or death due to hazardous excavations, the emergency response procedure in Section 20 will be followed	On-going	On-going	Senior Operational Manager

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Decommissioning	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Demolition Rehabilitation	H	M	• All existing and proposed mineralised waste facilities and water dams will be closed in a manner to ensure stability and related safety risks to third parties and animals are addressed. It will furthermore be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer. Provision will be made to address long term and safety risks in the decommissioning and rehabilitation planning	On-going	On-going	Professional engineer
				• Impala will survey its surface use area and update its surface use area map on a routine basis to ensure that the position and extent of all potential hazardous excavations, hazardous infrastructure and subsidence is known. It will further more ensure that appropriate management measures are taken to address the related safety risks to third parties and animals	As required	As required	Senior Operational Manager
				• During decommissioning planning of any part of the mine, provision will be made to address long term safety risks in the decommissioning and rehabilitation phases.	On-going	On-going	Senior Operational Manager
				• Where Impala has caused injury or death to third parties and/or animals, appropriate compensation will be provided	As required	As required	Senior Operational Manager
				• In case of injury or death due to hazardous excavations, the emergency response procedure in Section 20 will be followed.	As required	As required	Senior Operational Manager
Closure	Shaft WRD Maintenance and aftercare	H	M	• All existing and proposed mineralised waste facilities and water dams will be closed in a manner to ensure stability and related safety risks to third parties and animals are addressed. It will furthermore be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer. Provision will be made to address long term and safety risks in the decommissioning and rehabilitation planning	As required	As required	Senior Operational Manager
				• At closure of any part of the mine, the hazardous infrastructure will either have been removed or decommissioned and rehabilitated in a manner that it does not present a long term safety and/or stability risk.	As required	As required	Senior Operational Manager
				• At closure of any part of the mine the hazardous excavations and subsidence will have been dealt with as follows: o All shaft openings will have been sealed and rehabilitated o all pits will have been backfilled and rehabilitated o the potential for surface subsidence will have been addressed by providing underground support in mined out areas and by providing a bulking factor for	As required	As required	Senior Operational Manager

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				backfilled pits; o monitoring and maintenance will take place to observe whether the relevant long term safety objective have been achieved and to identify the need for additional intervention where the objectives have not been met. • In case of injury or death due to hazardous excavations, the emergency response procedure in 20 will be followed.	As required	As required	Senior Operational Manager

TABLE 51: ACTION PLAN – LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH POLLUTION

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply ans use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	H	L	• The mine will ensure that all hazardous chemicals (new and used), dirty water, mineralized wastes and non-mineralised wastes are transported, handled and stored in a manner that they do not pollute soils. This will be implemented through a procedure(s) covering the following: Pollution prevention through basic infrastructure design o Pollution prevention through maintenance of equipment o Pollution prevention through education and training of workers (temporary and permanent) o Pollution prevention through appropriate management of hazardous materials and waste o the required steps to enable fast reaction to contain and remediate pollution incidents. In this regard the remediation options include containment and in situ treatment or disposal of contaminated soils as hazardous waste. In situ treatment is generally considered to be the preferred option because with successful in situ remediation the soil resourced will be retained in the correct place. The in situ options include bioremediation at the point of pollution, or removal of soils for washing and/or bio remediation at a designated area after which the soils are returned o Specifications for post rehabilitation audit to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and it not, to recommend and implement further measures	As required	As required	Senior Operational Manager
Operation	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply ans use Water supply and use Transport systems Non-mineralised waste management General site management	H	L	• Implementation of Impala's management procedures for the handling and disposal of hazardous and non-hazardous materials	On-going	On-going	Senior Operational Manager

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	Other support services and amenities Rehabilitation			• In case of major spillage incidents the emergency response procedure in Section 20 will be followed.	As required	As required	Senior Operational Manager
Decommissioning	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply ans use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	H	L				
Closure	Shaft WRD General site management Maintenance and aftercare	H	L	• The designs of any permanent and potentially polluting structures (mineralized waste facilities) will take account of the requirements for long term soil pollution prevention, land function and confirmatory monitoring. • Implementation of Impalas soil management procedures, spillage control guideline and rehabilitation procedures • In case of major spillage incidents the emergency response procedure Section 20 will be followed.	As required As required As required	As required As required As required	Senior Operational Manager Senior Operational Manager Senior Operational Manager

TABLE 52: ACTION PLAN - LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Prospecting and survey activities Shaft WRD Opencast mining Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	H	L/M	• Limit the disturbance of soils to what is absolutely necessary for earthworks on-going activities, infrastructure footprints and use of vehicles • Where soils have to be disturbed the soils will be stripping, storage and maintenance and replaced in accordance with the specifications of the soil management principles included in Table 42 and the detailed Impala soils management procedure.	On-going On-going	On-going On-going	Senior Operational Manager Senior Operational Manager
Operation	Earthworks Prospecting and survey activities Shaft WRD Opencast mining Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation	H	L/M				
Decommissioning	Earthworks Prospecting and survey activities Shaft WRD Opencast mining Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	H	L/M				
Closure	Shaft WRD General site management Maintenance and aftercare	H	L/M	• As part of closure planning, the designs of any permanent land forms (eg). Mineralized waste facilities) will take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring.	At required	At required	Senior Operational Manager

TABLE 53: ACTION PLAN – PHYSICAL DESTRUCTION OF BIODIVERSITY

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	H/M	M/L	• Impala will implement a biodiversity management plan. The key components are: o Limit infrastructure, activities and related disturbance to those specifically identified and described in this report. o Prevent the disturbance of high biodiversity areas and important linkages between these areas so that the species composition and ecosystem functionality remain intact o Where a new area will be disturbed, the following will be implemented: o Delineation of any proposed areas that will be disturbed o Maintaining linkages between protection areas o Relocation of species were possible (especially protected species and species of conservation concern) o Restoration of the ecosystem functionality, as far as is possible, in areas that have been physically rehabilitated o Follow up audits and monitoring, in the short and long term to determine the success of the relocation, rehabilitation and restoration activities in terms of a range of species and ecosystem function performance indicators o If irreplaceable species and/or associated ecosystem functionality associated with high biodiversity or linkage areas will be permanently lost and restoration is not possible a biodiversity offset project will investigate. Issues that will be considered in the investigation are as follows: o the size of the affected area, o the conservation/sensitivity status, o the offset ration (in terms of the required size of the offset site) to be applied, o evaluation of alternative offset sites of the basis of: no net biodiversity loss compensation for the mines negative impact on biodiversity, long term functionality, long term viability, contribution to biodiversity conservation including linkages to areas of conservation importance, acceptability to key stakeholders, distances from other mines and development activities in relation to cumulative impacts, and biodiversity condition scores as	As required	As required	Senior Operational Manager
Operation	Site preparation Earthworks Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation	H/M	M/L				
Decommissioning	Site preparation Earthworks Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems	H/M	M/L				

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation			compared to that at the mine site. o land ownership now and in the future o status/security/sustainability of the offset site i.e. will it receive conservation status o measures to guarantee the security, management, monitoring and auditing of the offset o capacity of the mine to implement and manage the offset o identification of unacceptable risks associated with the offset o start-up and on-going costs associated with the offset for the life of the project o During the re-processing of the old tailings dam (No. 1&2), no activities will take place between September and October on the eastern boundary wall of the old tailings dam (No. 1&2) (adjacent to Shaft 4), as this is the active nesting period for numerous bird species. Ideally a 200 m buffer should not be disturbed during the nesting period. o Prior to the construction of the new tailings dam (No. 5), an ecological management plan for monitoring of the Giant Bull Frog will be implemented. This ecological management plan will focus on monitoring the Giant Bull Frog population and reporting any problems. Further to this the breeding site will be included into the water monitoring programme o Implementation of an alien/invasive /weed management to control the spread of these plants onto and from disturbed areas through active eradication, establishment of natural species and through on-going monitoring and assessment. In this regard, the use of herbicides will be controlled by only allowing registered Pest Control Operators (PCO) to administer any such chemical or biological agent.			
Closure	Shaft WRD General site management Maintenance and aftercare	H/M	M/L	• The designs of any permanent structures (mineralized waste facilities) will take into consideration the requirement for the establishment of long term species diversity, ecosystem functionality, aftercare and confirmatory monitoring	As required	As required	Senior Operational Manager

TABLE 54: ACTION PLAN – GENERAL DISTURBANCE OF BIODIVERSITY

Phase of	Activities (see Table 34)	Sig	Technical and management options	Action plan

operation		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	M	M/L	• the use of light is kept to a minimum, and where it is required, yellow lighting is used where possible • vertebrates should be kept away from the illuminated areas with appropriate fencing where feasible • internal power lines may be equipped with bird deterrent measures to prevent bird kills where deemed necessary • there is training for workers on the value of biodiversity and the need to conserve the species and systems that occur within the surface use area • there is zero tolerance of the killing or collecting of any biodiversity by anybody working for or on behalf of Impala • strict speed control measures are used for any vehicles driving within the surface use area • noisy and/or vibrating equipment will be well maintained to control noise and vibration emission levels • all permanent water dams(excluding the Rockwall dam) will be fenced off to prevent access by larger animals	On-going On-going On-going As required On-going On-going On-going As required	On-going On-going On-going As required On-going On-going On-going As required	Senior Operational Manager Senior Operational Manager Senior Operational Manager Senior Operational Manager Senior Operational Manager Senior Operational Manager Senior Operational Manager Senior Operational Manager
Operation	Site preparation Earthworks Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation	M	M/L	• dust control measures will be implemented • pollution and litter prevention measures will be implemented • Impala will monitor the aquatic environmental of all potentially affected surface water resources and use the results of the monitoring to implement any other surface water related interventions as deemed appropriate to achieve the mitigation objectives. This is will be out sourced as part of the Impala bio-monitoring in accordance to acceptable practice. • In case of a major incident the emergency response procedure Section 20 will be followed.	On-going On-going As required As required	On-going On-going As required As required	Senior Operational Manager Senior Operational Manager Senior Operational Manager Senior Operational Manager
Decommissioning	Site preparation Earthworks Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management	M	M/L				

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	General site management Other support services and amenities Demolition Rehabilitation						
Closure	Shaft WRD General site management Maintenance and aftercare	M	M/L	• As part of closure planning, the designs of any permanent and potentially polluting structures (mineralised waste facilities) will take consideration of the requirements for long term pollution prevention and confirmatory monitoring. • In case of a major incident the emergency response procedure in Section 20 will be followed.	As required As required	As required As required	Senior Operational Manager Senior Operational Manager

TABLE 55: ACTION PLAN – POLLUTION OF WATER RESOURCES

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	H	L	• Mine infrastructure, will be constructed and operated so as to comply with the National Water Act (36 of 1998) and Regulation 704 (4 June 1999): o Clean water systems are separated from dirty water systems: o Clean run-off and rainfall water is diverted around dirty areas and back into its normal flow in the environment o The location of all activities and infrastructure should be outside of the specified zones and /or floodlines of water courses. If this is unavoidable the necessary exemptions/approvals will be obtained. o The size of dirty water areas are minimized and dirty water is contained in systems that allow the reuse and/or recycling of this dirty water o discharges of dirty water may only occur in accordance with authorisations that are issued in terms of the relevant legislation specifications and they must not result in negative health impacts for downstream surface water users. The relevant legislation specifications comprises any applicable authorisation/exemption, the National Water Act (36 of 1998) and Regulation 704, or any future amendment thereto; and o the site wide water balance is refined on an on-going basis with the input of actual flow volumes and used as	On-going	On-going	Senior Operational Manager
Operation	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use	H	L				

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation			a decision making tool for water management and impact mitigation (Section 21.1.1). • All hazardous chemicals (new and used), mineralized waste and non-mineralised waste must be handled in a manner that they do not pollute surface water. This will be implemented by means of the following: o pollution prevention through basic infrastructure design o pollution prevention through maintenance of equipment o pollution prevention through education and training of workers (permanent and temporary) o pollution prevention through appropriate management of hazardous, materials and o the required steps to enable containment and remediation of pollution incidents o specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.	On-going	On-going	Senior Operational Manager
Decommission	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	H	L	• The designs of any permanent and potentially polluting structures will take account of the requirements for long term surface water pollution prevention. Moreover, where these facilities are associated with groundwater plumes that have or will impact the quality of surface water resources, Impala will implement mitigation measures for as long as is needed to eliminate the risk and achieve the stated mitigation objectives. An example of such a solution is to pump and treat the polluted groundwater so that it does not impact surface water resources.	As required	As required	Senior Operational Manager
Closure	Shaft WRD General site management Maintenance and aftercare	H	L	• Impala will monitor the water quality (Section 21.1.1) in all potentially affected surface water resources and use the monitoring results to implement appropriate mitigation measures to achieve surface water quality objectives.	On-going	On-going	Senior Operational Manager
				• Where monitoring results indicate that third party water supply has been polluted by Impala, Impala will ensure that an alternative equivalent water supply will be provided.	On-going	On-going	Senior Operational Manager
				• Implement Impala's water monitoring procedures included in Section 21	On-going	On-going	Senior Operational Manager
				• In case of a discharge incident that may result in the pollution of surface water resources, the emergency response procedure in Section 20 will be followed.	As required	As required	Senior Operational Manager

TABLE 56: ACTION PLAN – ALTERATION OF NATURAL DRAINAGE PATTERNS

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	H	M	• In all phases mine infrastructure will be constructed, operated and maintained so as to comply with the provisions of the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) of any future amendments thereto. These include: o clean water systems are separated from dirty water systems o the size of dirty water areas are minimized and clean run-off and rainfall water is diverted around dirty areas and back into the normal flow in the environment o the location of all activities and infrastructure should be outside of the specified zones and/or flood lines of watercourses. If this is unavoidable the necessary exemptions/approvals will be obtained. • Subject to water quality constraints, Impala will implement a system to control the release of water from Rockwall dam with the objective of limiting downstream quantity impacts.	On-going On-going	On-going On-going	Senior Operational Manager Senior Operational Manager
Operation	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation	H	M				

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Decommissioning	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	H	M				
Closure	Shaft WRD General site management Maintenance and aftercare	H	L				

TABLE 57: ACTION PLAN – CONTAMINATION OF GROUNDWATER

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities	H	L	• Impala will comply with both the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) • All hazardous chemicals (new and used), mineralized wastes and non-mineralised waste are handled in a manner that they do not pollute groundwater. This will be implemented by covering the following: o Pollution prevention through basic infrastructure design o Pollution prevention through maintenance of equipment o pollution prevention through education and training of workers (permanent and temporary); o Pollution prevention through appropriate management of hazardous chemicals, materials and non-mineralised waste o Required steps to enable containment and remediation of pollution incidents	On-going On-going	On-going On-going	Senior Operational Manager Senior Operational Manager

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	Demolition Rehabilitation			○ Specification for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures			
Operation	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation	H	L	• Future infrastructure that has the potential to pollute groundwater resources will be designed and implemented in a manner that pollution is addressed in all mine phases.	On-going	On-going	Senior Operational Manager
				• Existing and planned infrastructure that has the potential to pollute groundwater will be identified and included into the groundwater pollution management plan which will be implemented as part of the operational phase. The plan includes: ○ determine potential pollution sources, ○ determine the extent of the pollution plume, ○ design and implement intervention measures to prevent, eliminate and/or control the pollution plume. In terms of the tailings dam (No. 5) and the re-processing of the old tailings dam (No. 1&2) this may include: measures to reduce ponding and remove water from the dams, interception trenches along the perimeter of the dam, blasting curtains, scavenger wells and a pump and treat system amongst others. Further to this, during the detailed design phase, the potential to increase the slurry density of tailings dam No. 5 will be investigated. ○ monitoring all existing and potential impact zones (as per Impala's water management procedures include in (Section 21) to track pollution and mitigation impacts and ○ where monitoring results indicates that third party water supply has been polluted by Impala, Impala will ensure that an alternative equivalent water supply will be provided.	On-going	On-going	Senior Operational Manager
Decommissioning	Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	H	L	• Impala will continue to monitor groundwater quality within the surface use area in terms of Impala's exiting monitoring programme (Section 21)	On-going	On-going	Senior Operational Manager
				• In case of a major discharge incident that may result in the pollution of groundwater resources the emergency response procedure in Section 20 will be followed.	As required	As required	Senior Operational Manager
Closure	Shaft WRD General site management Maintenance and aftercare	H	L	• Future infrastructure that has the potential to pollute groundwater resources will be designed and implemented in a manner that pollution is addressed in all mine phases.	As required	As required	Senior Operational Manager
				• In case of a major discharge incident that may result in the pollution of groundwater resources the emergency response procedure in Section 20 will be followed.	As required	As required	Senior Operational Manager

TABLE 58: ACTION PLAN – DEWATERING

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Opencast mining	M	L	• All potentially affected third party boreholes will be included in the Impala groundwater monitoring program to ensure that changes in water depths can be identified, where possible.	On-going	On-going	Senior Operational Manager
Operation	Opencast mining	M	L				
Decommissioning	Opencast mining	M	L	• Where Impala's dewatering causes a loss of water supply to third parties an alternative equivalent water supply will be provided by Impala until such time as the dewatering impacts cease	As required	As required	Senior Operational Manager
				• Impala will continue to monitor groundwater quantity within the surface use area in terms of Impala's exiting monitoring programme (Section 21)	On-going	On-going	Senior Operational Manager
Closure	N/A	-	-	N/A	N/A	N/A	N/Q

TABLE 59: ACTION PLAN –AIR POLLUTION

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Transport systems Non-mineralised waste management Other support services and amenities Demolition Rehabilitation	H	M	• Impala will comply with the terms and conditions of air pollution authorisations/licenses. • Impala will implement a dynamic air quality management plan (Section 21.1.2) that covers: o the identification of sources and emissions inventory o the implementation of source based controls o the use of source and receptor based performance indicators and monitoring strategies o the use of source and receptor based mitigation measures o the use of internal and external auditing; and o review and plan adjustment as required.	As required	As Required	Senior Operational Manager
Operation	Site preparation Earthworks Civil works Prospecting and survey activities	H	M	• The following specific mitigation measures will be implemented for the main emission sources: roads, crushing and screening, materials handling (tipping points), the smelter complex, vehicles and wind erosion. The recommended methods include: o limit the disturbance of land to what is absolutely necessary and in accordance with the existing mine infrastructure layout	On-going	On-going	Senior Operational Manager

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	Shaft WRD Opencast mining Transport systems Non-mineralised waste management Other support services and amenities Rehabilitation						
Decommissioning	Site preparation Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Transport systems Non-mineralised waste management Other support services and amenities Demolition Rehabilitation	H	M	○ where possible roads will be paved and spillages of material on these paved roads must be routinely inspected and cleaned. Alternatively, Impala will apply dust suppression on unpaved roads through chemical binding agents and/or water sprays combined with vehicle speed controls. Out of pit haul roads associated with Pit14/15M will be situated as far as possible from the receptors and treated with water and chemical surfactants to ensure a 90% dust control efficiency. In the pit haul roads associated with Pit14/15M will be treated in a similar manner to ensure an 80% dust control efficiency; ○ dust controls at the crushing and screening operation by water sprays and/or installing extraction hoods with filters or scrubbers. At Pit 14/15M the water spray measures will be implemented to ensure an 80% control efficiency; ○ dust controls at material handling points (loading and offloading) At Pit 14/15M a dust control efficiency of 80% will be achieved by the application of water sprays to the loading and off-loading activities; ○ wet drilling will be applied to the pit drilling at Pit14/15M to ensure an 80% dust control efficiency; ○ mist blowers will be placed between Pit14/15M operations and the receptor areas of the farm dwellings and the Kultwanong school/old age home to suppress dust; ○ collection of spilled material and rehabilitation of areas where tailings spills occur along the pipe lines ○ rehabilitation and re-vegetation of all decommissioned areas; ○ vegetate the side slopes of the operational tailings dams. The target dust control efficiency is 60% achieved by re-vegetating 80% of the tailings side slopes; ○ maintenance of the SO2 and dust control infrastructure and systems that have been implemented at the smelter complex ○ maintenance of the SO2 data and dust control infrastructure and systems at the smelter complex; ○ maintenance of all vehicles to achieve optimal exhaust emissions. • The ambient and dust fallout monitoring programme will continue at Impala and the results thereof will be used to	On-going	On-going	Senior Operational Manager

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				determine appropriate emission controls and other relevant mitigation interventions. The following additional monitoring and mitigation measures will be applied to the receptor areas associated with the project components: o Additional equipment: o a single dust fallout bucket will be installed between the farm dwellings and the unpaved haul road associated with Pit 14/15M; o two dust fallout buckets will be installed at the Kutlwanong school/old age home, on its western and northern boundaries; o a single dust bucket will be placed between Freedom park and the nearest operational unpaved haul road; o a single dust bucket will be installed between the Freedom Park houses and the Z523 tarred road; o a single dust bucket will be installed to the north east of the tailings dam number 5; and o two PM10 samplers will be installed. One will be situated at the Kutlwanong school/old age home and one will be situated at the farm dwellings. o Additional data analysis and interventions: o monitoring of the PM10 concentrations at the farm dwellings and the Kutlwanong school/old age home and of the dust fallout at these two locations and at Freedom Park will be done by an independent contractor that will report to the farm dwellers, the Kutlwanong school/old age home management, Impala, the RBA Mining Committee and the Rustenburg Local Municipality every two weeks for the duration of the Pit14/15M operation. If the results show that the operation is within limits then the analysis intervals may be changed with agreement of relevant stakeholders, being Impala, representatives of the Kultwanong school and old age home, representative of the farm dwellers, the RBA mining committee and the Rustenburg Local Municipality. o should the relevant evaluation criteria for PM10 be exceeded at either Kutlwanong or the farm dwellings, the operation will be stopped until it is proven by an independent air specialist that the mitigation measures can be further improved to ensure compliance with the relevant evaluation			

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				criteria, or until the affected receptors are relocated from the zone of unacceptable impact; ○ should the relevant evaluation criteria for dust fallout be exceeded at Kutlwanong, the farm dwellings or Freedom Park, the dust fallout mitigation measures should be revisited in consultation with an independent air specialist.			
				• Impala will play an active role in regional organisations that exist for the purpose of addressing regional cumulative air impact concerns.	On-going	On-going	Senior Operational Manager
				• Impala will install non-ozone depleting substances in the refrigeration plants.	On-going	On-going	Senior Operational Manager
				• Implementation of an air complaints procedure	On-going	On-going	Senior Operational Manager
				• Impala will comply with its air quality monitoring procedures included in Section 21.1.2 and will comply with the existing Impala air quality management procedures;	On-going	On-going	Senior Operational Manager
				• In case of an emissions incident that may result in the exceedance of one or more of the evaluation criteria the emergency response procedure in Section 20 will be followed.	As required	As required	Senior Operational Manager
Closure	Shaft WRD Maintenance and aftercare	H	L	• As part of closure planning the designs of any permanent and potentially polluting structures (particularly the mineralized waste facilities) will, on the basis of impact modeling, incorporate measures to address long term pollution prevention and confirmatory monitoring.	As required	As required	Senior Operational Manager
				• In case of an emissions incident that may result in the exceedance of one or more of the evaluation criteria the emergency response procedure in Section 20 will be followed.	As required	As required	Senior Operational Manager

TABLE 60: ACTION PLAN – NOISE POLLUTION

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Transport systems Demolition	L	L	• All vehicles and equipment will be maintained to limit noise emissions	On-going	On-going	Senior Operational Manager
				• Al noise complaints will be documented, investigated and reasonable efforts made to address the area of concern. Options available for reducing noise impacts include: ○ Change operating hours ○ Equipping noise sources with silencers ○ Construction of noise attenuation measures such as noise berms and placing noise sources sub surface	On-going	On-going	Senior Operational Manager

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	Rehabilitation			○ Consulting a noise specialist for mitigation advice			
Operation	Site preparation Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Transport systems Rehabilitation	L	L	• Measures specific to Pit 14/15M are as follows : ○ open pit activities at Pit 14/15M will be limited to a single day time shift; ○ a noise and safety berm (5 m high and 30 m wide) will be constructed between the Pit 14/15M and Kutlwanong to mitigate noise impacts on the school and old age home. A continuous vegetated topsoil stockpile (10 m high) will be positioned on the western side of Pit 14/15M to mitigated noise impacts on the farm dwellings; ○ Daily noise monitoring will be undertaken by an independent contractor that will report to the Kutlwanong school/old age home management and Impala on a weekly basis. This monitoring will be situated at the Kutlwanong buildings located in the western section of the grounds within approximately 150 m of the noise and safety berm. If monitoring indicates that the ambient noise levels are unacceptable in this or any other area, the mining activities will be stopped until such time as mitigation measures are improved to reduce the noise to acceptable levels or alternative equivalent facilities are provided by Impala outside of this impact zone but within the Kutlwanong grounds. ○ acoustic engineering measures will be applied to all buildings at Kutlwanong that are used for schooling and caring for the aged so that noise levels therein are appropriate for the purposes of schooling and caring for people.	On-going	On-going	Senior Operational Manager
Decommissioning	Site preparation Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Transport systems Demolition Rehabilitation	L	L	• Where necessary noise monitoring will be used as part of the investigatory process into noise complaints and as part of the assessment of the impact of mitigation and, if required, the alteration thereof.	As required	As required	Senior Operational Manager
Closure	Shaft WRD	L	L	-	-	-	-

TABLE 61: ACTION PLAN – BLASTING DAMAGE

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Opencast mining Demolition	H	M	• Implementation of a blast management programme (Section 21.1.4) which has the following principles:	On-going	On-going	Senior Operational Manager

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				○ Pre mining structure and crack survey of structures within the potential impact zone ○ Design of blasts to prevent injury to people and livestock and to prevent damage to structures. As a minimum the blast design will achieve: ○ a fly rock zone limit of less than 500 m ○ a peak velocity limit of less than 12 mm/s at third party structures that are built according to building industry standards and that is further reduced at third party structures that are not built according to building industry standards ○ an air blast limit of less than 125 dB at third party structures ○ Communication of the planned blast programme to interested and affected parties ○ pre-blast warning and evacuation to clear people, traffic, moveable property and livestock from the potential impact zone ○ blast monitoring to verify the effectiveness of the blast design and blast execution ○ audit and review to adjust the blast design where necessary to achieve the stated objectives ○ formal documented investigation and response for all third party blast related complaints ○ remediation of all impacts caused by blasting			
Operation	Opencast mining	H	M				
Decommissioning	Opencast mining Demolition	H	M				
				• No blasting will take place within 500 m of any third party structures. Where Impala would like to blast in areas within this 500 m distance, a project specific risk assessment will be completed and project specific mitigation measures will be implemented, subject to approval by the relevant authority(ies)	On-going	On-going	Senior Operational Manager
				• A safety berm (5 m high and 30 m wide) will be constructed between Pit 14/15M and Kutlwanong	On-going	On-going	Senior Operational Manager
				• Given the proximity of the Kutlwanong school/old age home and the farm dwellings, Impala will implement a specific evacuation plan for every blast at Pit 14/15M. The evacuation plan will ensure the following: ○ all people and farm animals are evacuated out of the impact zone before each blast by Impala. In addition to this, all the pigs, fowls and goats at the farm dwellings will be moved to an alternative secure facility for the duration that the current enclosure is within the blasting impact zone. The exact details of the alternative secure facility will be clarified between Impala and the farm	On-going	On-going	Senior Operational Manager

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				dwellers; ○ the evacuation of the school children, elderly and staff at Kutlwanong will be done at the least intrusive time to the evacuees. This will be agreed between the relevant Kutlwanong management and Impala; ○ any bed ridden people at the old age home will be permanently relocated for at least the duration of the project to an equal or better facility of their choice by Impala; ○ activities that are beneficial to the evacuees and that are agreed to by the Kutlwanong management will be provided by Impala for the duration of each evacuation. By way of example, school children may be taken for sports and extramural activities at appropriate facilities, staff may be taken for skills development, and the elderly may be taken for beneficial medical treatment that they would not otherwise receive; and ○ All related expenses will be covered by Impala.			
				• Any disputes relating to blasting damages associated with Pit14/15M and related remedies at the Kutlwanong school and old age home as well as the farm dwellers will be be taken up with Impala and the RBA and if necessary will be resolved through formal arbitration.	As required	As required	Senior Operational Manager
				• In case of a person or animal being injured by blasting activities the emergency response procedure in Section 20 will be followed.	As required	As required	Senior Operational Manager
Closure	N/A	-	-	-	-	-	-

TABLE 62: ACTION PLAN – TRAFFIC IMPACT

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Transport systems	H	M	• Impala will implement a transport safety programme to achieve the mitigation objectives. Key components of the programme include: ○ Education and awareness training ○ Maintenance of the transport system	On-going	On-going	Senior Operational Manager
Operation	Transport systems	H	M				
Decommissioning	Transport systems	H	M				
				• Transnet will be contacted by Impala to evaluate the safety aspects associated with the intersection of the Transnet railway line and the Z532 and to implement the required intersection upgrades	On going	On going	Senior Operational Manager
				• Impala will facilitate communication between the North West Roads Department, municipal engineers (where relevant)	As required	As required	Senior Operational Manager

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				and community leadership with a view to improving the safety of pedestrians on the private Impala roads. Options to consider in these discussions are: o Channelising of pedestrians (especially school children) to selected pedestrian crossings o Provision of signage to create awareness of pedestrian crossings o road safely education and awareness for pedestrians			
				• The required tarred road diversion at Pit 9U_B will be implemented in accordance with the safety considerations that will be recommended by a professional traffic and roads engineer.	On-going	On-going	Senior Operational Manager
				• The gravel access roads used by project traffic will be cordoned off by fencing in the vicinity of Pit 14/15M to prevent access by third party traffic, people and animals. An alternative route to the farm will be provided by Impala. The alternative routes to both the farm and to Kutlwanong will be maintained by Impala.	On-going	On-going	Senior Operational Manager
				• In case of a person or animal being injured by transport activities the emergency response procedure in Section 20 will be followed.	As required	As required	Senior Operational Manager
Closure	N/A	-	-	-	-	-	-

TABLE 63: ACTION PLAN – VISUAL IMPACTS

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services	M	L	• Limit the clearing of vegetation	On-going	On-going	Senior Operational Manager
				• Limit the emission of visual air emission plumes (dust and stack fugitive emissions)	On-going	On-going	Senior Operational Manager
				• Use of visual screening berms in areas where there are sensitive visual receptors. With reference to the re-processing of the old tailings dam (No. 1&2), the western wall of the old tailings dam (No 1&2) will be re-processed at the end of the project so that it acts as a visual screen between Luka and the project and berms will be in place on the west and east of Pit14/15M..	On-going	On-going	Senior Operational Manager
				• Use of lighting will be limited to project requirements and measures will be implemented to limit light pollution impacts on surrounding areas; and	As required	As required	Senior Operational Manager
				• On-going vegetation establishment on rehabilitated areas and the tailings dam side slopes	As required	As required	Senior Operational Manager

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	and amenities Demolition Rehabilitation			• Painting infrastructure with colours that blend in with the surrounding environment where possible			
Operation	Site preparation Earthworks Civil works Prospecting and survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation	M	L				
Decommissioning	Site preparation Earthworks Civil works Prospecting and survey activities Shafts Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	M	L	• Implementation of the Impala closure plan which involves the removal of infrastructure, and the rehabilitation and re-vegetation of cleared areas and any final land forms that will remain post closure. These final landforms should be rehabilitated in a manner that both achieves landscape functionality and limits and/or enhances the long term visual impact	As required	As required	Senior Operational Manager
Closure	Shaft WRD General site management Maintenance and aftercare	M	L	• Final land forms will be managed through a care and maintenance programme to limit and/or enhance the long term post closure visual impacts	As required	As required	Senior Operational Manager

TABLE 64: ACTION PLAN – DESTRUCTION OF HERITAGE, PALEONTOLOGICAL AND CULTURAL RESOURCES

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	N/A	-	-	• If there are any chance finds of heritage and/or cultural sites, Impala will follow its emergency response procedure included in Section 20.	As required	As required	Senior Operational Manager
Operation	N/A	-	-				
Decommissioning	N/A	-	-				
Closure	N/A	-	-				

TABLE 65: ACTION PLAN – ECONOMIC IMPACT

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	All activities	M+	H+	• Impala (and its contractors) will hire local people from the closest communities where possible	As required	As required	Stakeholder engagement department
Operation	All activities	M+	H+	• Impala will extend its formal bursary and skills development programmes to the closest communities to increase the number of local skilled people and thereby increase the potential local employee base	On-going	On-going	Stakeholder engagement department
Decommissioning	All activities	M+	H+	• Impala will ensure it procures local goods and services from the closest communities where possible	On-going	On-going	Stakeholder engagement department
Closure	All activities	M+	H+	• Impala will implement a procurement mentorship programme which provides support to local businesses from the enquiry to project delivery stages	On-going	On-going	Stakeholder engagement department
				• Where farming land is lost to mining, the affected farmer(s) will be provided with alternative suitable land by facilitating discussions with the Royal Bafokeng Administration (RBA) and if this is not feasible alternative compensation will be provided	As required	As required	Stakeholder engagement department
				• Impala will ensure that it incorporates economic considerations into tis closure planning from the outset	As required	As required	Stakeholder engagement department
				• Closure planning considerations cover the skilling of employees for the downscaling, early closure and long term closure scenarios	As required	As required	Stakeholder engagement department
				• It identified and develops sustainable business opportunities and skills, independent form mining for members of the local communities to ensure continued economic prosperity beyond the life of mine.	As required	As required	Stakeholder engagement department

TABLE 66: ACTION PLAN – INWARD MIGRATION

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	All activities	H	H/M	• In terms of recruitment, procurement and training: ○ good communication with all job and procurement opportunity seekers will be maintained throughout the recruitment process. The process must be seen and understood to be fair and impartial by all involved. The personnel in charge of resolving recruitment and procurement concerns must be clearly identified and accessible to potential applicants; ○ the precise number of new job opportunities (permanent and temporary) and procurement opportunities will be made public together with the required skills and qualifications. The duration of temporary work will be clearly indicated and the relevant employees/contractors provided with regular reminders and revisions throughout the temporary period; ○ recruitment and procurement, by Impala and its contractors, will be preferentially provided to people in the communities where possible, that are closest to Impala. In order to be in a position to achieve this a skills register of people within the closest communities will be maintained. Impala will also preferentially provide bursaries and training to people that reside in these closest communities; ○ there will be no recruitment or procurement at the gates of the mine. All recruitment will take place off site, at designated locations in the closest communities. All procurement will be through existing, established procurement and tendering processes that will include mechanisms for empowering service providers from the closest communities	On-going	On-going	Stakeholder engagement department
Operation	All activities	H	H/M				
Decommissioning	All activities	H	H/M				
				• Impala acknowledges that it is responsible for ensuring that its employees and contractors are housed in formal serviced housing. This will be achieved by: ○ allocating an accommodation or an allowance to all employees that can demonstrate that they live in formal housing; and ○ by maintaining an employee profile (for Impala and contractor employees) that can be used as a tool to identify socio-economic concerns and plan long term mitigation interventions	On-going	On-going	Stakeholder engagement department
				• Impala will work with its neighbours, local authorities and law enforcement officials to monitor and prevent the development of informal settlements near the mine and to	On-going	On-going	Stakeholder engagement department

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				assist where possible with crime prevention within the surface use area			
				• Impala will implement a health policy on HIV/AIDS and tuberculosis. This policy will promote education, awareness and disease management both in the workplace and in the home so that the initiatives of the workplace have a positive impact on the communities from which employees are recruited. Partnerships will be formed with local and provincial authorities to maximize the off-site benefits of the policy.	On-going	On-going	Stakeholder engagement department
				• Impala will work closely with the local and regional authorities, the Royal Bafokeng Administration and other mine/industries in the areas to be part of the problem solving process that needs to address social service constraints.	On-going	On-going	Stakeholder engagement department
				• Impala will implement a stakeholder communication, information sharing and grievance mechanism to enable all stakeholders to engage with Impala on both socio-economic and environmental issues	As required	As required	Stakeholder engagement department
Closure	N/A	-	-	-	-	-	-

TABLE 67: ACTION PLAN – LAND USE IMPACTS

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Prospecting anf survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities	H	M	• Impala will implement the EMP commitments with a view not only to prevent and/or mitigate the various environmental and social impacts, but also to prevent negative impacts on surrounding land uses.	As required	As required	Senior Operational Manager
				• Impala will specifically liaise with the RBA regarding the closure of the proposed new tailings dam (No. 5) in order to minimise long term land use impacts on the proposed heritage park.	As required	As required	Senior Operational Manager
				• If monitoring indicates that the dust mitigation measures at Pit14/15M cannot keep the dust concentrations within the relevant evaluation criteria then the affected receptors will have to be relocated in order for operations to continue. The related relocation issues have not been investigated and assessed as part of this report. This relocation assessment will form part of a separate assessment process that will be done in accordance with relevant legislation and the International Finance Corporation/World Bank standards	As required	As required	Senior Operational Manager

Phase of operation	Activities (see Table 34)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	Demolition Rehabilitation			and guidelines on resettlement. The related governing principle is that relocated people have to be placed in the same or better circumstances from a residential, social, cultural, environmental and economic perspective. • Alternative land and/or compensation will be provided to all directly affected farmers. The provision of alternative land will be addressed in consultation with the Royal Bafokeng Administration. If a situation arises where any other surrounding land use is negatively affected by the mine, Impala will take steps to prevent the impact. If the land use impact cannot be prevented, Impala will work with landowners in the area to provide alternative land that is acceptable to the affected land user for the land use. Alternatively, Impala will provide compensation for mine-related loss of land use.	As required	As required	Senior Operational Manager
Operation	Site preparation Earthworks Civil works Prospecting anf survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Rehabilitation	H	M				
Decommissioning	Site preparation Earthworks Civil works Prospecting anf survey activities Shaft WRD Opencast mining Power and compressed air supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition Rehabilitation	H	M				
Closure	Shaft WRD General site management Maintenance and aftercare	H	L	• Closure planning will incorporate measures to achieve the future land use plans for the land within the impala surface use area	As required	As required	Senior Operational Manager

20 EMERGENCY RESPONSE PROCEDURES

20.1 ON-GOING MONITORING AND MANAGEMENT MEASURES

The on-going monitoring as described in Section 21 will be undertaken to provide early warning systems necessary to avoid environmental emergencies.

20.2 PROCEDURES IN CASE OF ENVIRONMENTAL EMERGENCIES

Emergency procedures apply to incidents that are unexpected and that may be sudden, and which lead to serious danger to the public and/or potentially serious pollution of, or detriment to the environment (immediate and delayed). Procedures to be followed in case of environmental emergencies are described in the table below (Table 68).

20.2.1 GENERAL EMERGENCY PROCEDURE

The general procedure that should be followed in the event of all emergency situations is as follows.

- Applicable incident controller defined in emergency plans must be notified of an incident upon discovery;
- Area to be cordoned off to prevent unauthorised access and tampering of evidence;
- Undertake actions defined in emergency plant to limit/contain the impact of the emergency
- If residue facilities/dams, stormwater diversions, etc., are partially or totally failing and this cannot be prevented, the emergency siren is to be sounded (nearest one available). After hours the Operations Engineer on shift must be notified;
- Take photographs and samples as necessary to assist in investigation;
- Report the incident immediately to the environmental department for emergencies involving environmental impacts or to the safely department in the case of injury;
- The Environment department must comply with Section 30 of the National Environmental Management Act (107 of 1998) such that:
    - The Environment department must immediately notify the Director-General (DWA and DEA, DMR and Inspectorate of Mines as appropriate), the South African Police Services, the relevant fire prevention service, the provincial head of DEDECT, the head of the local municipality, the head of the regional DWA office and any persons whose health may be affected of;
        - The nature of the incident;
        - Any risks posed to public health, safety and property;
        - The toxicity of the substances or by-products released by the incident; and
        - Any steps taken to avoid or minimise the effects of the incident on public health and the environment.
    - The Environment department must as soon as is practical after the incident:

- Take all reasonable measures to contain and minimise the effects of the incident including its effects on the environment and any risks posed by the incident to the health, safety and property of persons;
- Undertake clean up procedures;
- Remedy the effects of the incident; and
- Assess the immediate and long term effects of the incident (environment and public health);

o Within 14 days the Environment department must report to the Director-General DWA and DEA, the provincial head of DEDECT, the regional manager of the DMR, the head of the local and district municipality, the head of the regional DWA office such information as is available to enable an initial evaluation of the incident, including:

- The nature of the incident;
- The substances involved and an estimation of the quantity released;
- The possible acute effects of the substances on the persons and the environment (including the data needed to assess these effects);
- Initial measures taken to minimise the impacts;
- Causes of the incident, whether direct or indirect, including equipment, technology, system or management failure; and
- Measures taken to avoid a recurrence of the incident.

20.2.2 IDENTIFICATION OF EMERGENCY SITUATIONS

The site wide emergency situations that have been identified together with specific emergency response procedures are outlined in Table 68.

20.3 TECHNICAL, MANAGEMENT AND FINANCIAL OPTIONS

Technical, management and financial options that will be put into place to deal with the remediation of impacts in cases of environmental emergencies are described below.

- The applicant will appoint a competent management team with the appropriate skills to develop and manage a mine of this scale and nature.
- To prevent the occurrence of emergency situations, the mine will implement as a minimum the mine plan and mitigation measures as included in this EIA and EMP report.
- The mine has an environmental management system in place where all operation identify, report, investigate, address and close out environmental incidents.
- As part of its annual budget, the mine will allow a contingency for handling of any risks identified and/or emergency situations.
- Where required, the mine will seek input from appropriately qualified people.

TABLE 68: EMERGENCY RESPONSE PROCEDURES

Item	Emergency Situation	Response in addition to general procedures
1	Spillage of chemicals, engineering substances and waste	Where there is a risk that contamination will contaminate the land (leading to a loss of resource), surface water and/or groundwater, Impala will: • Notify residents/users downstream of the pollution incident. • Identify and provide alternative resources should contamination impact adversely on the existing environment. • Cut off the source if the spill is originating from a pump, pipeline or valve (e.g. Tailings delivery pipeline, refuelling tanker) and the infrastructure 'made safe'. • Contain the spill (e.g. construct temporary earth bund around source such as road tanker). • Pump excess hazardous liquids on the surface to temporary containers (e.g. 210 litre drums, mobile tanker, etc.) for appropriate disposal. • Remove hazardous substances from damaged infrastructure to an appropriate storage area before it is removed/repaired.
2	Discharge of dirty water to the environment	Apply the principals listed for Item 1 above. To stop spillage from the dirty water system the mine will: • Redirect excess water to other dirty water facilities where possible; • Pump dirty water to available containment in the clean water system, where there is no capacity in the dirty water system; and • Carry out an emergency discharge of clean water and redirect the spillage to the emptied facility. • Apply for emergency discharge as a last resort.
3	Pollution of surface water	Personnel discovering the incident must inform the Environment department of the location and contaminant source. Apply the principals listed for Item 1 above. Absorbent booms will be used to absorb surface plumes of hydrocarbon contaminants. Contamination entering the surface water drainage system should be redirected into the dirty water system. The Environment department will collect in-stream water samples downstream of the incident to assess the immediate risk posed by contamination.
4	Groundwater contamination	Use the groundwater monitoring boreholes as scavenger wells to pump out the polluted groundwater for re-use in the process water circuit (hence containing the contamination and preventing further migration). Investigate the source of contamination and implement control/mitigation measures.
5	Burst water pipes (loss of resource and erosion)	Notify authority responsible for the pipeline (if not mine responsibility). Shut off the water flowing through the damaged area and repair the damage. Apply the principals listed for Item 1 above if spill is from the dirty/process water circuit.
6	Flooding from failure of surface water control infrastructure	Evacuate the area downstream of the failure. Using the emergency response team, rescue/recover and medically treat any injured personnel. Temporarily reinstate/repair stormwater diversions during the storm event (e.g. emergency supply of sandbags). Close the roads affected by localised flooding or where a stormwater surge has destroyed crossings/bridges.

Item	Emergency Situation	Response in addition to general procedures
7	Risk of drowning from falling into water dams	Attempt rescue of individuals from land by throwing lifeline/lifesaving ring. Get assistance of emergency response team whilst attempting rescue or to carry out rescue of animals and or people as relevant. Ensure medical assistance is available to recovered individual.
8	Veld fire	Evacuate mine employees from areas at risk. Notify downwind residents and industries of the danger. Assist those in imminent danger/less able individuals to evacuate until danger has passed. Provide emergency fire fighting assistance with available trained mine personnel and equipment.
9	Overtopping or failure of the tailings dam	Sound the alarm to evacuate danger area. Pump water from top of dam and follow redirection of water as indicated in Item 2 above. Stop pumping tailings to the tailings. Recover casualties resulting from dam failure using the emergency response team. Make the remaining structure safe. Apply the principles of Item 1 above.
10	Falling into hazardous excavations	Personnel discovering the fallen individual or animal must mobilise the emergency response team to the location of the incident and provide a general appraisal of the situation (e.g. human or animal, conscious or unconscious, etc.). The injured party should be recovered by trained professionals such as the mine emergency response team. A doctor (or appropriate medical practitioner)/ambulance should be present at the scene to provide first aid and transport individual to hospital.
11	Road traffic accidents (on site)	The individual discovering the accident (be it bystander or able casualty) must raise the alarm giving the location of the incident. Able personnel at the scene should shut down vehicles where it is safe to do so. Access to the area should be restricted and access roads cleared for the emergency response team. Vehicles must be made safe first by trained professionals (e.g. crushed or overturned vehicles). Casualties will be moved to safety by trained professionals and provided with medical assistance. Medical centres in the vicinity with appropriate medical capabilities will be notified if multiple seriously injured casualties are expected. A nearby vet should be consulted in the case of animal injury
12	Development of informal settlements	The mine will inform the local authorities (municipality and police) that people are illegally occupying the land and ensure that action is taken within 24hrs.
13	Injury from fly rock	The person discovering the incident will contact the mine emergency response personnel to recover the injured person or animal and provide medical assistance. Whilst awaiting arrival of the emergency response personnel, first aid should be administered to the injured person by a qualified first aider if it is safe to do so.
14	Uncovering of graves and sites	Personnel discovering the grave or site must inform the Environment department immediately. Prior to damaging or destroying any of the identified graves, permission for the exhumation and relocation of graves must

Item	Emergency Situation	Response in addition to general procedures
		be obtained from the relevant descendants (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local Police. The exhumation process must comply with the requirements of the relevant Ordinance on Exhumations, and the Human Tissues Act, 65 of 1983.
15	Uncovering of fossils	Personnel discovering the fossil or potential site must inform the Environment department immediately. Should any fossils be uncovered during the development of the site, a palaeontologist or paleoanthropologist will be consulted to identify the possibility for research.

21 PLANNED MONITORING AND EMP PERFORMANCE ASSESSMENT

21.1 PLANNED MONITORING OF ENVIRONMENTAL ASPECTS

Environmental aspects requiring monitoring are listed below.

- Water resources – see Section 21.1.1 for details
- Air – see Section 21.1.2 for details
- Biodiversity – see Section 21.1.3 for details
- Blasting – see Section 21.1.4 for details
- Waste dumps– see Section 21.1.5 for details

21.1.1 WATER RESOURCES

Groundwater and surface water

Impala has an existing extensive groundwater and surface water monitoring programme that was developed in consultation which a qualified groundwater specialist. Figure 18 and Figure 19 sets out Impala's existing groundwater and surface water monitoring points respectively within the surface use area as well as the frequency which water quality and quantity are measured. Table 69 sets out the parameters that are monitored. Water quality analyses results are classified in terms of the DWAF Guidelines Domestic Water Supply (1999), the DWAF guidelines for livestock watering, IFC mining Effluent Limits and SANS guideline limits.

TABLE 69: MONITORING PARAMETERS FOR ANALYSIS AND REPORTING

In field measurements		
pH	Electrical conductivity	-
Laboratory analysis		
pH	Ammonium	Calcium
Electrical conductivity	Iron	Magnesium
Temperature	Lead	Sodium
Sulphate	Nickel	potassium
Total dissolved salts (TDS)	Zinc	Nitrate
Total alkalinity as $CaCO_3$	Copper	Sodium absorption rate
Fluoride	Manganese	Total hardness as $CaCO_3$
Phosphate	COC	Aluminium

Surface water monitoring points that are currently part of Impala's existing surface water monitoring programme will be used to monitor surface water in the vicinity of the proposed Pit8C and Shaft 16 WRD expansion site in (Figure 19). Existing boreholes (Figure 18) within the vicinity of the project areas will be utilised to measure groundwater quality and quanity.

If monitoring indicates a mine-related decrease in groundwater supply to third parties or groundwater quality at third party boreholes, appropriate measures will be taken to prevent the decrease from

occurring or rectify the contamination situation, and/or to provide the affected third parties with an alternative equivalent water supply.

Process water

Rainfall related discharges are monitored as required according to the parameters in Table 69. If the quality of the monitored discharge is above acceptable levels, additional measures will be identified and implemented to prevent the future potential for surface water related pollution.

Water balance

The water balance for the Impala operations is updated on a monthly basis from recorded flow measurements and production figures. This is done by an appropriately qualified person.

21.1.2 AIR QUALITY

Impala has an existing monitoring programme aimed at monitoring selected ambient parameters, including dust fall-out as well as selected operational parameters at identified sources. This monitoring programme was developed in consultation with appropriately qualified air specialists and monitors both source and receptor site. The air monitoring programme includes:

- the identification of sources;
- the implementation of source based controls;
- the use of source and receptor based performance indicators and monitoring strategies;
- the use of source and receptor based mitigation measures;
- the use of internal and external auditing; and
- review and plan adjustment as required.

Impala Platinum operates various ambient monitoring stations which provides a good indication of ambient concentrations attributed to various activities and sources in and around our area of operation. Various meteorological parameters as well as PM_{10} and SO_2 are measured at three stations located in Boshoek, Luka, and at Impala Central Services Offices.

Impala's existing dust fallout network comprises 36 monitoring points and is monitored on a monthly basis. Several monitoring points in the vicinity of the proposed Pit8C and Shaft 16 WRD expansion sites will be used for monitoring purposes.

21.1.3 BIODIVERSITY MONITORING PROGRAMME

On-going monitoring

Prior to the construction of any future project, detailed baseline studies of selected fauna and flora groups within the impact zone will be undertaken. During operation and decommissioning, Impala will implement

a monitoring programme which will be aimed at monitoring selected indicator species. This monitoring, which will include the species selection and determination of monitoring intervals, will be performed by a specialist.

Alien invasive species programme

During operation, decommissioning and closure Impala will implement an alien/invasive /weed management programme to control the spread of these plants onto and form disturbed areas. This will be achieved by active eradication and the establishment of natural species and through on-going monitoring and assessment. The use of herbicides will be limited and focussed and will only be used under strict controls. Herbicides will be selected to ensure least residual harm. Herbicides will be administered by suitably qualified people.

Continued monitoring will be undertaken to ensure that the alien invasive species have been eradicated and are controlled for both controlled sites as well as rehabilitated areas. Repeat surveys should be carried out annually for at least the first three years post-rehabilitation.

Rehabilitation

For each area requiring rehabilitation specific landscape functionality objectives will be set with expert input and the associated targets and monitoring program will follow accordingly.

21.1.4 BLASTING

Prior to the construction phase of future projects, Impala will undertake a pre-blast baseline survey as detailed in the action plan (Section 19).

Monitoring of each surface blast will take place for the duration of blasting activities. Points for off-site vibration and airblast monitoring will be identified in consultation with surrounding landowners and a blast monitoring specialist. The monitoring results will be documented and maintained for record-keeping and auditing purposes.

21.1.5 MINERALISED WASTE FACILITIES AND WATER DAMS

In addition to the abovementioned environmental monitoring programmes, all mineralised waste facilities will be monitored to ensure stability, safety and prevention of environmental impacts. The frequency of the monitoring and the qualification of the monitoring personnel will be determined on an infrastructure specific basis.

The findings will be documented for record-keeping and auditing purposes and addressed where relevant to achieve the stated objectives.

21.2 AUDITING AND PERFORMANCE ASSESSMENTS

The environmental department manager will conduct internal management audits against the commitments in the EMP. These audits will be conducted on an on-going basis until final closure. The audit findings will be documented for both record keeping purposes and for informing continual improvement. In addition, and in accordance with mining regulation R527, an independent professional will conduct an EMP performance assessment every 2 years. The site's compliance with the provisions of the EMP and the adequacy EMP report relative to the on-site activities will be assessed in the performance assessment.

21.3 FREQUENCY FOR REPORTING

As a minimum, the following documents will be submitted to the relevant authorities from the start of construction until mine closure:

- EMP performance assessment, submitted every two years to DMR;
- updated closure and rehabilitation cost estimate, submitted to the DMR in accordance to DMR requirements;
- water monitoring reports, submitted to DWA in accordance with water use license;
- air quality monitoring reports, submitted to the relevant authority (currently under review) in accordance with the air emissions license; and
- detailed plan for decommissioning/closure, submitted in accordance to DMR requirements.

FIGURE 18: GROUNDWATER MONITORING PROGRAMME

FIGURE 19: SURFACE WATER MONITORING PROGRAMME

FIGURE 20: AIR QUALITY MONITORING PROGRAMME

22 FINANCIAL PROVISION

The information in this section was sourced from the closure cost calculation study completed by Etek (Appendix G).

22.1 PLAN SHOWING LOCATION AND AERIAL EXTENT OF PROPOSED OPERATION

Plans showing the location and aerial extent of the entire Impala operation including the proposed new projects are included in the following figures:

- Overall infrastructure layout A (Figure 21);
- Overall infrastructure layout B (Figure 22);
- Overall infrastructure layout C (Figure 23);
- Overall infrastructure layout D (Figure 24);
- Overall infrastructure layout E (Figure 25); and
- Overall infrastructure layout F (Figure 26).

22.2 ANNUAL FORECASTED FINANCIAL PROVISION

The current scheduled liability for all current Impala operations including the proposed projects is **R860 384 100.78** and the unscheduled liability is **R 844 270 423.60.** The proposed Pit8C project only has a project life of approximately 12 to 18 months and as such a ten year forecast is not available. Refer to Table 70 below for the unscheduled and scheduled closure amounts for the proposed Pit8C project.The annual forecasted financial provision for the first 10 years of the proposed Shaft 16 WRD, as well as the scheduled closure amount is provided in Table 70 below.

TABLE 70: FINANCIAL PROVISION FOR THE PROPOSED PIT8C PROJECT (ETEK, SEPTEMBER 2012)

Year	Financial provision (R, excluding VAT)
1	6 723 131.86
2	663 940.64
Life of project (scheduled closure)	**0**

TABLE 71: FINANCIAL PROVISION FOR THE PROPOSED SHAFT 16 WRD PROJECT (ETEK, SEPTEMBER 2012)

Year	Financial provision (R, excluding VAT)
1	787 286.68
2	1 050 486.10
3	1 135 843.87
4	1 204 205.34
5	1 986 083.18
6	1 694 302.01
7	1 713 593.61

Year	Financial provision (R, excluding VAT)
8	1 732 885.21
9	1 752 176.81
10	1 771 468.41
Life of project (scheduled closure)	**2 421 089.61**

22.3 CONFIRMATION OF AMOUNT TO BE PROVIDED

This will be confirmed in consultation with the DMR.

22.4 METHOD OF PROVIDING FINANCIAL PROVISION

The funding method is in accordance with the DMR methods.

FIGURE 21: OVERALL INFRASTRUCTURE LAYOUT A

FIGURE 22: OVERALL INFRASTRUCTURE LAYOUT B

FIGURE 23: OVERALL INFRASTRUCTURE LAYOUT C

FIGURE 24: OVERALL INFRASTRUCTURE LAYOUT D

FIGURE 25: OVERALL INFRASTRUCTURE LAYOUT E

FIGURE 26: OVERALL INFRASTRUCTURE LAYOUT F

23 ENVIRONMENTAL AWARENESS PLAN

This section includes an environmental awareness plan for the mine. The plan describes how employees will be informed of environmental risks which may result from their work, the manner in which the risk must be dealt with in order to avoid pollution or degradation of the environment and the training required for general environmental awareness and the dealing of emergency situations and remediation measures for such emergencies.

All contractors that conduct work on behalf of Impala are bound by the content of the EMP and a contractual condition to this effect will be included in all such contracts entered into by the mine. If contractors are used, the responsibility for ensuring compliance with the EMP will remain with Impala.

The purpose of the environmental awareness plan is to ensure that all personnel and management understand the general environmental requirements of the site. In addition, greater environmental awareness must be communicated to personnel involved in specific activities which can have a significant impact on the environment and ensure that they are competent to carry out their tasks on the basis of appropriate education, training and/or experience. The environmental awareness plan should enable Impala to achieve the objectives of the environmental policy.

23.1 ENVIRONMENTAL POLICY

Impala will display the environmental policy. To achieve world class environmental performance in a sustainable manner Impala is currently committed to:

- Integrating environmental management into all aspects of our business, including the entire product life cycle;
- Complying with all applicable legislation and other requirement to which Impala subscribes;
- Practising responsible stewardship by adopting world class standards;
- Proactively identifying and managing significant environmental aspects in order to:
    - Minimise emissions to atmosphere:
    - Minimise the release of effluent;
    - Optimise resource consumption;
    - Mitigate our impacts on climate change;
    - Minimise waste;
    - Rehabilitate disturbed land and protect environmental biodiversity; and
    - Protect cultural heritage resources.
- Ensuring environmental awareness and appropriate competency among employees and promoting environmental awareness in the community
- Engaging with all IAPs towards the shared goal of improving the environment;

- Setting objectives and, where possible, quantitative targets, to determine continual improvement in environmental performance and the prevention of pollution

23.2 STEPS TO ACHIEVE THE ENVIRONMENTAL POLICY OBJECTIVES

Impala's environmental policy will be realised by setting specific and measurable objectives. It is proposed that new objectives are set throughout the life of mine, but initial objectives are as follows:

- Management of environmental responsibilities:
  - Impala will establish and appoint Managers at senior mine management level at each site, who will be provided with all necessary resources to carry out the management of all environmental aspects of the site irrespective of other responsibilities, for example:
    - Compliance with environmental legislation and EMP commitments;
    - Implementing and maintaining an environmental management system with the assistance of the appointed EMS Area Coordinator and the Area Waste Coordinator;
    - Developing environmental emergency response procedures and coordinating personnel during incidents;
    - Manage routine environmental monitoring and data interpretation;
    - Environmental trouble shooting and implementation of remediation strategies; and
    - Closure planning.
- Communication of environmental issues and information:
  - Meetings, consultations and progress reviews will be carried out, and specifically Impala will:
    - Set the discussion of environmental issues and feedback on environmental projects as an agenda item at all company board meetings;
    - Provide progress reports on the achievement of policy objectives and level of compliance with the approved EMP to the Department of Minerals Resources;
    - Ensure environmental issues are raised at monthly mine management executive committee meetings and all relevant mine wide meetings at all levels; and
    - Ensure environmental issues are discussed at all general liaison meetings with local communities and other interested and affected parties.
- Environmental awareness training:
  - Impala will provide environmental awareness training to individuals at a level of detail specific to the requirements of their job, but will generally comprise:
    - Basic awareness training for all prior to granting access to site (e.g. short video presentation requiring registration once completed). Employees and contractors who have not attended the training will not be allowed on site.
    - General environmental awareness training will be given to all employees and contractors as part of the Safety, Health and Environment induction programme. All non-Impala personnel who will be on site for more than three days must undergo the SHE induction training.

  - Specific environmental awareness training will be provided to personnel whose work activities can have a significant impact on the environment (e.g. workshops, waste handling and disposal, sanitation, etc.).
- Review and update the environmental topics already identified in the EMP which currently includes the following purpose
  - Topography (hazardous excavations);
  - Soil and land capability management (loss of soil resource);
  - Management of biodiversity;
  - Surface water management (alteration of surface drainage and pollution of surface water);
  - Groundwater management (reduction in groundwater levels/availability and groundwater contamination);
  - Management of air quality (dust generation);
  - Noise (specifically management of disturbing noise);
  - Visual aspects (reduction of negative visual impacts);
  - Surrounding land use (traffic management, blast management, land use loss);
  - Heritage resources (management of sites);
  - Socio-economic impacts (management of positive and negative impacts);
- All mine projects will be designed to minimise impact on the environment and to accomplish closure/rehabilitation objectives.
- Impala will maintain records of all environmental training, monitoring, incidents, corrective actions and reports.

23.3 TRAINING OBJECTIVES OF THE ENVIRONMENTAL AWARENESS PLAN

The environmental awareness plan ensures that training needs are identified and that appropriate training is provided. The environmental awareness plan should communicate:

- The importance of conformance with the environmental policy, procedures and other requirements of good environmental management
- The significant environmental impacts and risks of individuals work activities and explain the environmental benefits of improved performance
- Individuals roles and responsibilities in achieving the aims and objectives of the environmental policy
- The potential consequences of not complying with environmental procedures.

23.3.1 GENERAL CONTENTS OF THE ENVIRONMENTAL AWARENESS PLAN

To achieve the objectives of the environmental awareness plan the general contents of the training plans are as follows:

- Module 1 – Basic training plan applicable to all personnel entering the site:
  - Short (15 min) presentation to indicate the site layout and activities at specific business units together with their environmental aspects and potential impacts.

  - Individuals to sign off with site security on completion in order to gain access to the site.
- Module 2 – General training plan applicable to all personnel at the site for longer than 3 days:
  - General understanding of the environmental setting of the mine (e.g. local communities and industries and proximity to natural resources such as rivers);
  - Understanding the environmental impact of individuals activities on site (e.g. excessive production of waste, poor housekeeping, energy consumption, water use, noise, etc.);
  - Indicate potential site specific environmental aspects and their impacts;
  - Impala's environmental management strategy;
  - Identifying poor environmental management and stopping work which presents significant risks;
  - Reporting incidents;
  - Examples of poor environmental management and environmental incidents; and
  - Procedures for emergency response and cleaning up minor leaks and spills.
- Module 3 – Specific training plan:
  - Environmental setting of the workplace (e.g. proximity of watercourses, vulnerability of groundwater, proximity of local communities and industries, etc.);
  - Specific environmental aspects such as:
    - Spillage of hydrocarbons at workshops;
    - Spillage of explosive liquids in the open pits;
    - Poor waste management such as mixing hazardous and general wastes, inappropriate storage and stockpiling large amounts of waste;
    - Poor housekeeping practices;
    - Poor working practices (e.g. not carrying out oil changes in designated bunded areas);
    - Excessive noise generation and unnecessary use of hooters; and
    - Protection of heritage resources (including palaeontological resources).
  - Impact of environmental aspects, for example:
    - Hydrocarbon contamination resulting in loss of resource (soil, water) to downstream users;
    - Groundwater contamination also resulting in loss of resource due to potential adverse aesthetic, taste and health effects; and
    - Dust impacts on local communities (nuisance and health implications).
  - Impala's duty of care (specifically with respect to waste management); and
  - Purpose and function of Impala's environmental management system.

Individuals required to complete Module 3 (Specific training module) will need to complete Modules 1 and 2 first. On completion of the Module 3, individuals will be subject to a short test (written or verbal) to ensure the level of competence has been achieved. Individuals who fail the test will be allowed to re-sit the test after further training by the training department.

The actual contents of the training modules will be developed based on a training needs analysis.

Key personnel will be required to undergo formal, external environmental management training (e.g. how to operate the environmental management system, waste management and legal compliance).

In addition to the above Impala will:

- Conduct refresher training/presentations on environmental issues for mine employees (permanent and contractors) at regular intervals.
- Promote environmental awareness using relevant environmental topic posters displayed at strategic locations on the mine. These topics will be changed monthly, and will be reviewed annually by the Environmental Department Manager to ensure relevance.
- Participate and organise events which promote environmental awareness, some of which will be tied to national initiatives e.g. National Arbour Week, World Environment Day and National Water Week.

24 TECHNICAL SUPPORTING INFORMATION

The following specialist studies are attached as appendices to this report:

- Heritage Impact Assessment (Appendix E)
- Economic Land Use and Sustainability Analysis (Appendix F)
- Financial provision (Appendix G)
- WRD design report (Appendix H)

25 CAPACITY TO MANAGE AND REHABILITATE THE ENVIRONMENT

25.1 AMOUNT REQUIRED TO MANAGE AND REHABILITATE THE ENVIRONMENT

The mine manages the environmental impacts throughout the value chain and puts preventative and mitigating measures in place to achieve this. It is the mines policy to always adopt best practice and the capital budget provided by the mine to manage all identified environmental aspects for five year period from the 2012 financial year is R410 million. The direct operational budget for the 2012 financial year is R12 million.

25.2 AMOUNT PROVIDED FOR

The amount required as per the above budget has been provided for in the current Impala budgeting period.

26 UNDERTAKING SIGNED BY APPLICANT

COMMITMENT/UNDERTAKING BY APPLICANT

I,.....

the undersigned and duly authorised thereto by

.....……

undertake to adhere to the requirements and to the conditions set out in the approved EMP with the exception of the exemption(s) and amendment(s) agreed to be relevant by the Regional Manager: _____ (include relevant province).

Signed at: .....……

On: .....

Signature: ……...…….

Designation: ……..…….

REGIONAL MANAGER: _____ REGION

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) this document of …… is approved subject to the conditions as set out in the letter of approval.

Signed at: .....……...

On: .....

Signature: ……..

Designation: ……..

REGIONAL MANAGER: _____

27 ENVIRONMENTAL IMPACT STATEMENT & CONCLUSION

This document presents the project plan as defined by Impala, presents findings of specialist studies, identifies and assesses potential impacts on the receiving environment in both the unmitigated and mitigated scenarios, including cumulative impacts, and identifies measures together with monitoring programmes to monitor and mitigate potential impacts.

A summary of the potential impacts (as per Section 7 of the EIA/EMP report), associated with the chosen alternatives (as per Section 2 of the EIA/EMP report), in the unmitigated and mitigated scenarios for all project phases is included in Table 72 below.

TABLE 72: SUMMARY OF POTENTIAL CUMULATIVE IMPACTS

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)	
		Unmitigated	Mitigated
Geology	Loss and sterilisation of mineral resources	**M**	**L**
Topography	Hazardous excavations and infrastructure	**H**	**M**
Soils and land capability	Loss of soil resources and land capability through pollution	**H**	**L**
	Loss of soil resources and land capability through physical disturbance	**H**	**L (M for WRD**
Biodiversity	Physical destruction of biodiversity	**H (M for WRD)**	**M-L**
	General disturbance of biodiversity	**M**	**M-L**
Surface water	Pollution of water resources	**H**	**L**
	Alteration of natural drainage lines	**H**	**M**
Groundwater	Contamination of groundwater	**H**	**L**
	Dewatering	**M**	**L**
Air quality	Air pollution	**H**	**M**
Noise	Noise pollution	**L**	**L**
Blasting	Blasting impacts	**H**	**M**
Traffic	Road disturbance and traffic safety	**H**	**M**
Visual	Visual impacts	**M**	**L**
Heritage, palaeontological and cultural resources	Loss of heritage, palaeontological and cultural resources	**N/A**	**N/A**
Socio-economic	Economic impact	**M+**	**H+**
	Inward migration	**H**	**H-M**
Land use	Land use impact	**H**	**L**

The assessment of the proposed project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the bio-physical, cultural and socio-economic environments

both on the project sites and in the surrounding area. With mitigation these potential impacts can be prevented or reduced to acceptable levels.

The economic impact assessment concluded that the development of the proposed projects will have significant positive economic impacts. Moreover, the integrated alternative land use assessment concluded that the proposed project components are the preferred land use alternative.

It follows that provided the EMP is effectively implemented there is no environmental, social or economic reason why the project should not proceed.

Caitlin Pringle **Natasha Daly** **Brandon Stobart**

SLR Consulting (Africa) (Pty) Ltd

28 REFERENCES

Airshed Planning Professionals (Pty) Ltd, March 2012: Air Quality Impact Assessment for the proposed Impala Tailings Dam and Open Pits Expansion Projects

Cambraim CC, December 2011: Blasting report for the proposed open pit expansions at Impala Platinum – Pit9U_B and Pit 14/15M

Earth Science Solutions, February 2010: Impala Platinum Mine paedeological and land capability studies consolidation project

E-TEK Consulting, September 2012: Impala Platinum Limited Closure Costing Report for Proposed New Open Pit8C project

E-TEK Consulting, September 2012: Impala Platinum Limited Closure Costing Report for Proposed Shaft 16 Waste Rock Dump Expansion

Groundwater Consulting Services (GCS), 2004: Groundwater Numerical Model for the Shaft 16 Complex-Impala Platinum Limited

Golder Associates Africa (Pty) Ltd, September 2006: Addendum to the Approved Environmental Management Programme Report for Impala Platinum Shaft 17

Impala Platinum Limited Environmental Standards, April 2008: Soil Management

Impala Platinum Limited Environmental Standards, April 2009: General Waste

Julius Pistorius, February 2011: A phase 1 Cultural-Heritage Impact Assessment (HIA) study for Impala Platinum Limited's (Impala) proposed new tailings facility, expansion of one open pit and re-processing of the old tailings dam in the Rustenburg (Bafokeng) district of the North-West Province

Julius Pistorius, September 2012: A Phase 1 Heritage Impact Assessment (HIA) Study for the Impala Platinum Limited's (Impala) Proposed Opencast Pit8C and the Expansion of the Shaft 16 Waste Rock Dump in the North-West Province

Knight Piesold Consulting, 2009: Impala Platinum Limited Environmental Design Recommendations for WRDs

Metago Environmental Engineers (Pty) Ltd January 2005: Amendment to the Environmental Management Programme Report for Impala Platinum Limited, Rustenburg Operations

Metago Environmental Engineers (Pty) Ltd. September 2011: Surface Water Assessment and Floodline Modelling for Impala Platinum Mine

Metago Environmental Engineers (Pty) Ltd, September 2011: Groundwater model for the extensions of a Tailings storage facility at Impala Platinum Limited

Metago Environmental Engineers (Pty) Ltd, March 2012: Desktop Review: Reclamation of tailings storage dam No. 1&2., Impala Platinum Limited, Groundwater study

Natural Scientific Solutions, August 2011: Biodiversity assessment for the proposed tailings dam and open cast expansion projects, Impala Platinum Limited, North West Province

Newton Landscape Architects, March 2011: The proposed tailings dam projects and the expansion of one open pit, Visual Environmental Assessment

North West University, November 2010: Biodiversity study for the Impala Bafokeng Mining Complex

Partridge, Maud and Associates, March 2006: Report on a survey cracking damage to houses in the villages of Seretube and Mafika, in the proximity to Impala Platinum's Proposed No. 17 Shaft

Peter Wade and Jenny Glass, July 2008: Characterisation of Mine Residue, Council for Geoscience, Report No. IMPL-08-7512

SLR Consulting (South Africa) (Pty) Ltd, December 2011: Groundwater Impact Assessment 18, &19 Shaft

SGS Environmental, October 2011, Test Report: Final Annual Dsut Deposition Monitoring Progress Report July 2010 – June 2011, Impala Platinum Limited

SGS Environmental, August 2012, Test Report: Final Annual Dsut Deposition Monitoring Progress Report July 2011 – June 2012, Impala Platinum Limited

SLR, January 2013, Design report Impala # 16 Shaft Waste Rock Dump

Strategy4Good, May 2011: Socio-economic improvements on many levels in labour areas

Strategy4good, June 2011: Scoping economic profile

Strategy4Good, March 2012: Economic and sustainable development cost and benefits analysis of alternative land-use for Impala mine expansion projects

Strategy4Good, September 2012: Alternative Landuse Economic Assessment

University of Witwatersrand, BPI for Palaeontological Research, April 2011: Impala Proposed Tailings Dam Projects and expansion of Open Pit – Palaeontological Impact Assessment

APPENDIX A: INFORMATION SHARING WITH AUTHORITIES

- Correspondence with Land Claims Commission
- Correspondence with DWA following site visit on 11 November 2011
- Pre-application meeting minutes with DMR (23 May 2012)
- Proof of WULA submission
- Proof of DEDECT application
- Notification to relevant authorities
- Proof of distribution of scoping report to relevant authorities
- Comments received from relevant authorities

APPENDIX B: IAP DATABASE

APPENDIX C: INFORMATION SHARING WITH IAPS

- Letter of intent for information-sharing purposes.
- Original site notices displayed in the project area (English and Tswana) and site notice photos.
- Placement of advertisements in the Platinum Weekly and Rustenburg Herald.
- Minutes of focussed scoping meeting held with the RBA at Phokeng Civic Centre on 30 July 2012
- Minutes of focussed scoping meeting held with Future Forum at Shaft 6 Boardroom on 17 August 2012
- Proof of distribution of Scoping report and summary documents to IAPs
- Scoping report summary (English and Tswana).
- EIA/EMP report summary (English and Tswana).

APPENDIX D: COMMENTS AND RESPONSE REPORT

APPENDIX E: HERITAGE IMPACT ASSESSMENT

APPENDIX F: ECONOMIC LAND USE AND SUSTAINABILITY ANALYSIS

APPENDIX G: FINANCIAL PROVISION

APPENDIX H: WRD EXPANSION DESIGN REPORT BY SLR

RECORD OF REPORT DISTRIBUTION

SLR Reference:	710.09003.00092
Title:	ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED SHAFT 16 WASTE ROCK DUMP EXPANSION AND OPENCAST ACTIVITIES AT PIT8C
Report Number:	1
Proponent:	Impala Platinum Limited

Name	Entity	Copy No.	Date issued	Issuer
Advokate Kenneth Mokate	Royal Bafokeng Mining Committee	1-3	January 2013	C Pringle
Teresea Taljaard			January 2013	C Pringle
Reotsephile Tlhapane			January 2013	C Pringle
Future Forum (wards 4, 23, 24 and 38)	Future Forum	4-7	January 2013	
Annah Kgaswane/Josephine Krzyzanowska	Impala Platinum Limited	8	January 2013	C Pringle
Phumlani Dlamini		9	January 2013	C Pringle
Phumudzo Nethwazi/Shadrack Fhedzisani	Department of Mineral Resources	10-15	January 2013	C Pringle
Piet Theron	Department of Agriculture, Forestry and Fishery	16	January 2013	C Pringle
Jacqueline Nkosi	Department of Rural Development and Land Reform	17	January 2013	C Pringle
Philip Tjale	Department of Water Affairs	18	January 2013	C Pringle
Kathryn Smuts	South African Heritage Resources Association	Electronic copy	January 2013	C Pringle
Librarian	SLR Library	19	January 2013	C Pringle
Johanna Tau	Impala Stakeholder Department	20	January 2013	C Pringle
J. Pienaar	Rustenburg Libary	21	January 2013	C Pringle
Tshepo Lenake/Kelebogile Mekgoe	Rustenburg Municipality	22-23	January 2013	C Pringle
Nozi Masekwane	Bojanala Platinum District Municipality	24	January 2013	C Pringle
Chris de Bruyn	North West Eco Forum	25	January 2013	C Pringle