mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

BASIC ASSESSMENT REPORT

And

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

NAME OF APPLICANT: Sishen Iron Ore Company

TEL NO: 053 739 2821

FAX NO: 053 739 2179

POSTAL ADDRESS: Private Bag X506, Kathu 8446

PHYSICAL ADDRESS: Hendrik Van Eck Street, Kathu 8446

FILE REFERENCE NUMBER SAMRAD: N/A

Basic Assessment Report and Environmental Management Programme Report: Lylyveld North WRD and Haul Road Expansions

An EOH Company

Technical Report: **E-R-2015-05-02**

Prepared for: **Sishen Iron Ore Company (Pty) Ltd**

Prepared by: **Exigo Sustainability (Pty) Ltd**

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PART A

SCOPE OF ASSSSMENT AND BASIC ASSESSMENT REPORT

1. CONTACT PERSON AND CORRESPONDENCE ADDRESS

1.1 Details and expertise of the EAP

Name of The Practitioner: Exigo Sustainability (Pty) Ltd

Tel No.: 012 751 2160

Fax No. : 086 607 2406

e-mail address: michael@exigo3.com

Table 1: EAP expertise

EAP	Qualifications	Years' experience
Mr. Michael Grobler	BSc Hons. Conservation Ecology. M. OL - Pr.Sci.Nat;	11 years
Mrs Reneé Kruger	M. Environmental Management	7 years

CV's with experience is attached as APPENDIX A: CV'S OF THE EAP TEAM.

2. LOCATION OF THE OVERALL ACTIVITY

A description of the property on which the proposed project is located is provided in Table 2 and shown in Figure 1.

Table 2: Locality of the activity

Farm Name:	Lylyveld 545 and Bruce 544
Application area (Ha)	7.5 ha
Magisterial district:	Kuruman
Distance and direction from nearest town	7.5 km south from the town of Kathu
21 digit Surveyor General Code for each farm portion	CO41000000000545000001 CO41000000000544000001

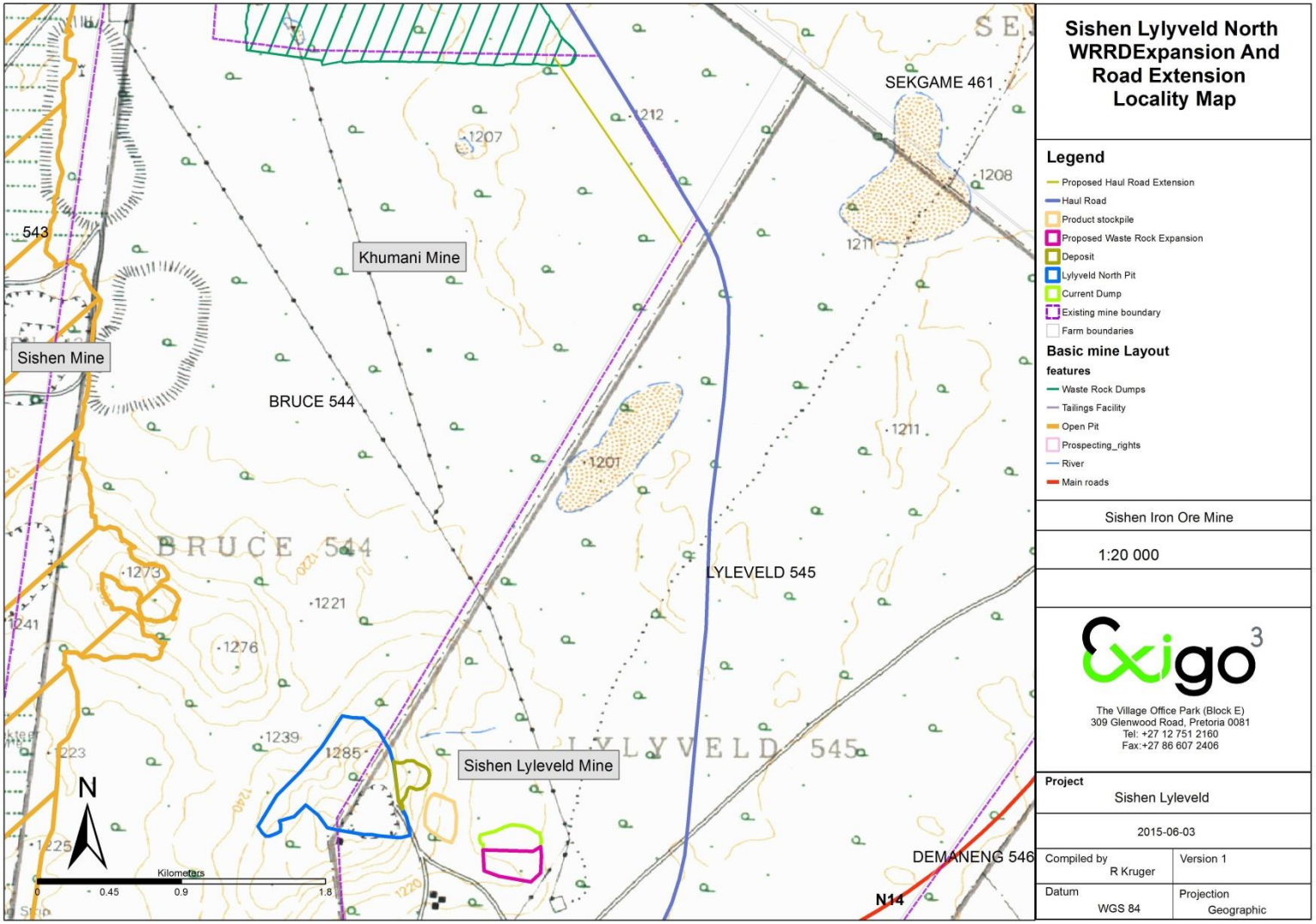


Figure 1: Regional Locality Map

2.1 **Description of the scope of the proposed overall activity**

2.1.1 Plan showing location of listed activities and associated infrastructure

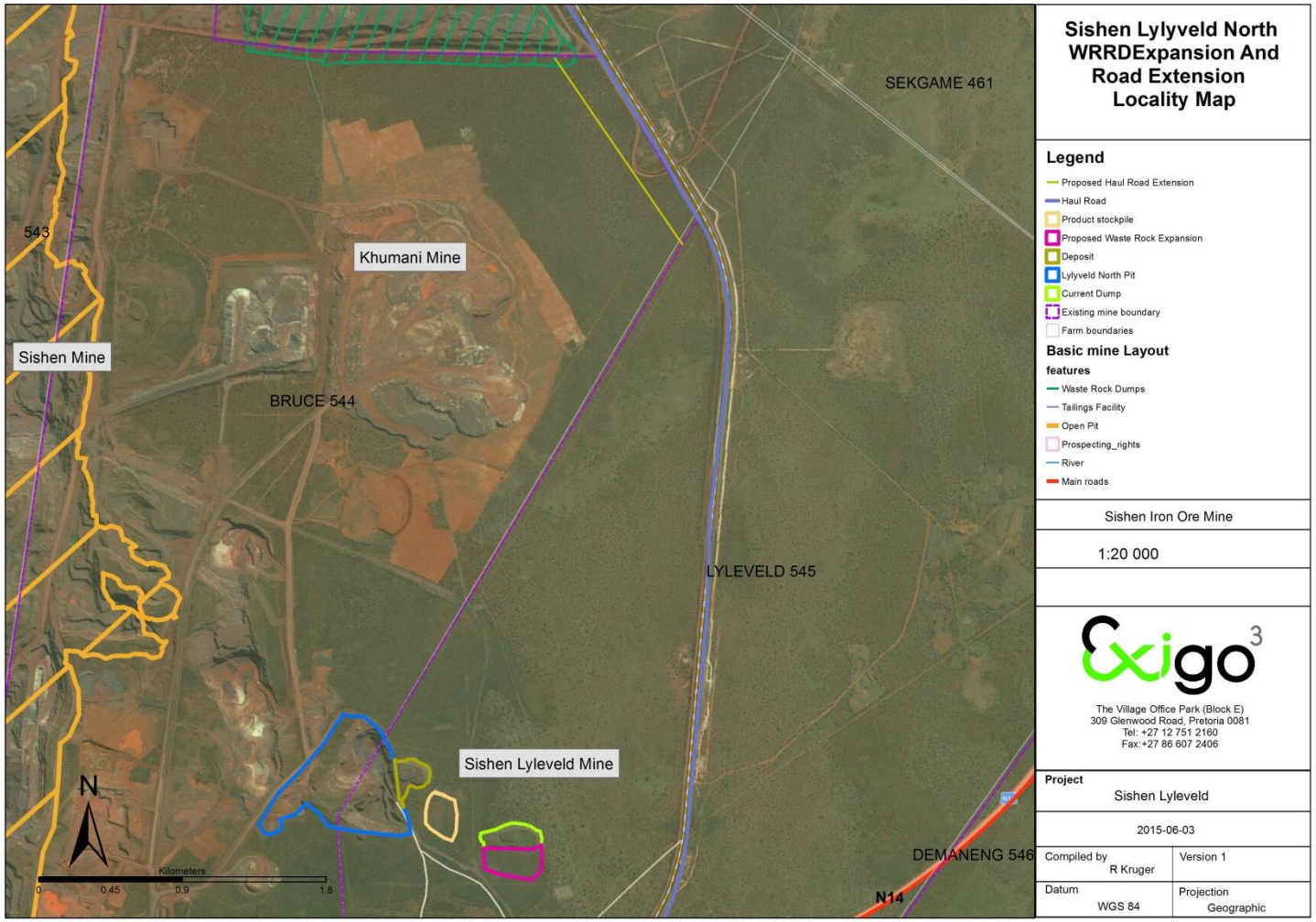


Figure 2: Aerial Locality Map

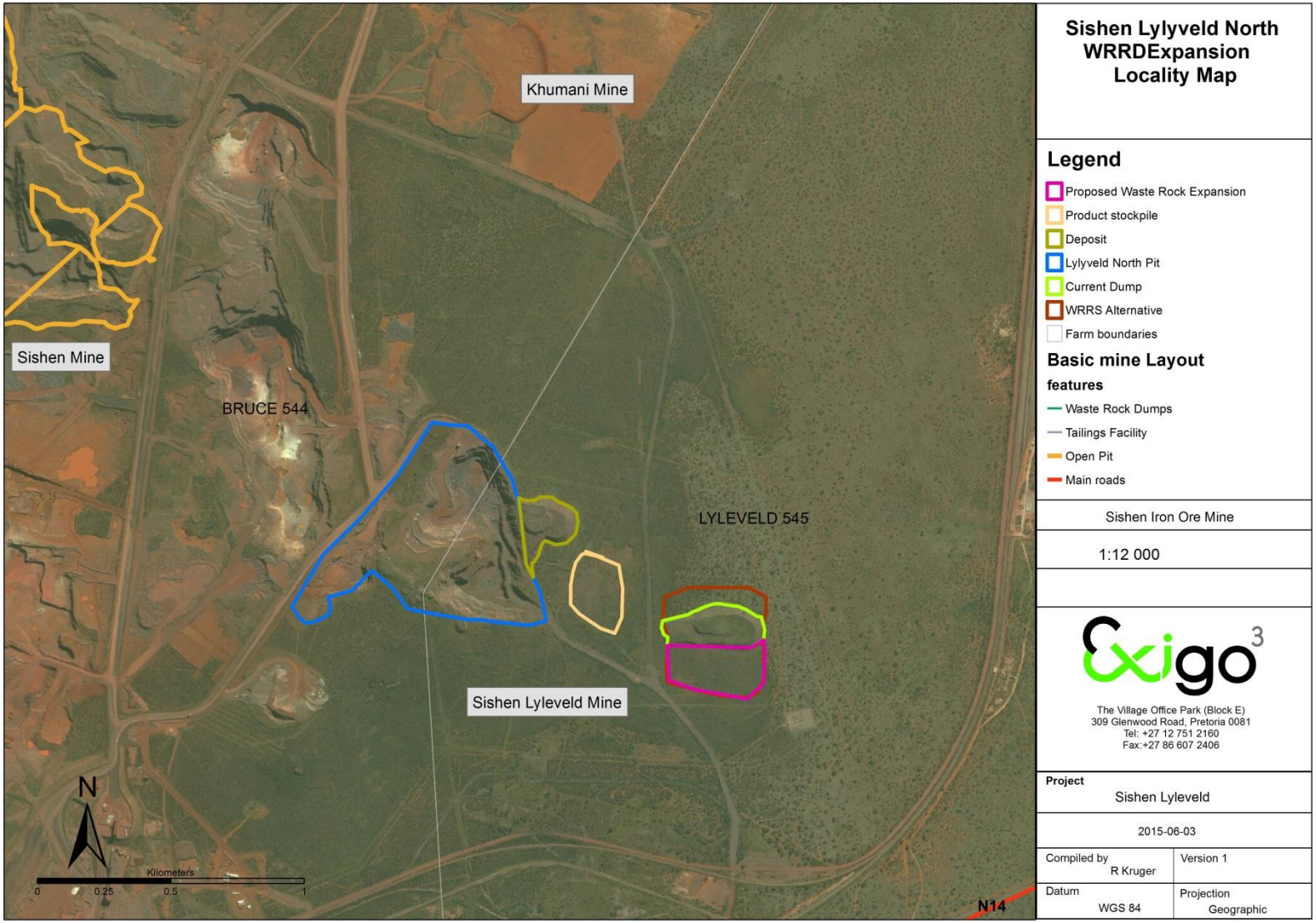


Figure 3: Lylyveld North Dump Expansion layout

2.2 Listed and specified activities

Table 3: List of Activities in terms of NEMA

Name of Activity	Aerial extent of the Activity (Ha or m²)	Listed Activity	Applicable Listing Notice (*GNR (983, 984, 985)*
Extension of Haul Road	1.5ha	X	GN 983 –NEMA Listing Notice 1 of 2014 Activity 56
Expansion of Lylyveld North Waste Rock Residue Deposit	5.0 ha	X	GN 983 – NEMA Listing Notice 1 of 2014 Activity 27

Table 4: List of Activities in terms of NEMWA

Name of Activity	Aerial extent of the Activity (Ha or m²)	Listed Activity	Applicable Listing Notice (NEMWA: GNR 921)
Expansion of Lylyveld North Waste Rock Residue Deposit	5.0 ha	X	Category A: – Activity 9 and Activity 13

3. DESCRIPTION OF THE ACTIVITIES TO BE UNDERTAKEN

3.1 Lylyveld North Expansion of Waste Rock Residue Deposit

Lylyveld North has an existing Waste Rock Residue Deposit (WRRD). The dump was created in the 1980's. It has however become evident that additional dumping space needs to be created for approximately 1,480,000m3 of waste rock coming from the 30m eastern pit wall pushback. Only 130 000m³ can be absorbed by the haul road and safety berms, therefore justifying a need to expand the existing waste rock.

The total expansion footprint will be approximately 5ha. Indigenous vegetation clearance will be required as well as a waste licence for the expansion of a waste facility.

Water will be sourced from existing sources as authorised in the current water use licence.

3.2 Lylyveld Haul Road Expansion over the farm Bruce

SIOC wants to construct a new haul road over land belonging to a neighbouring (Khumani) mining company. The two companies are in process of sorting out the contractual agreements.

The proposed road over Khumani's property will be 30m x 1800m and will be an extension of the current Lylyveld North Haul Road (Figure 7). Waste rock will be used for the road base construction. The current Lylyveld North haul road and the proposed extension over Khumani will cater for Komatsu 795 trucks that will be used to transport ore from Lylyveld North to Sishen Mine. A photo of the current Lylyveld North haul road is displayed in Figure 5.

Indigenous vegetation will have to be cleared for the purpose of constructing the proposed road.

The construction of the Lylyveld North haul road was previously approved by the Department of Environment and Nature Conservation in in May 2013. An amendment was granted in 2015 for a deviation of the haul road (see Figure 4)

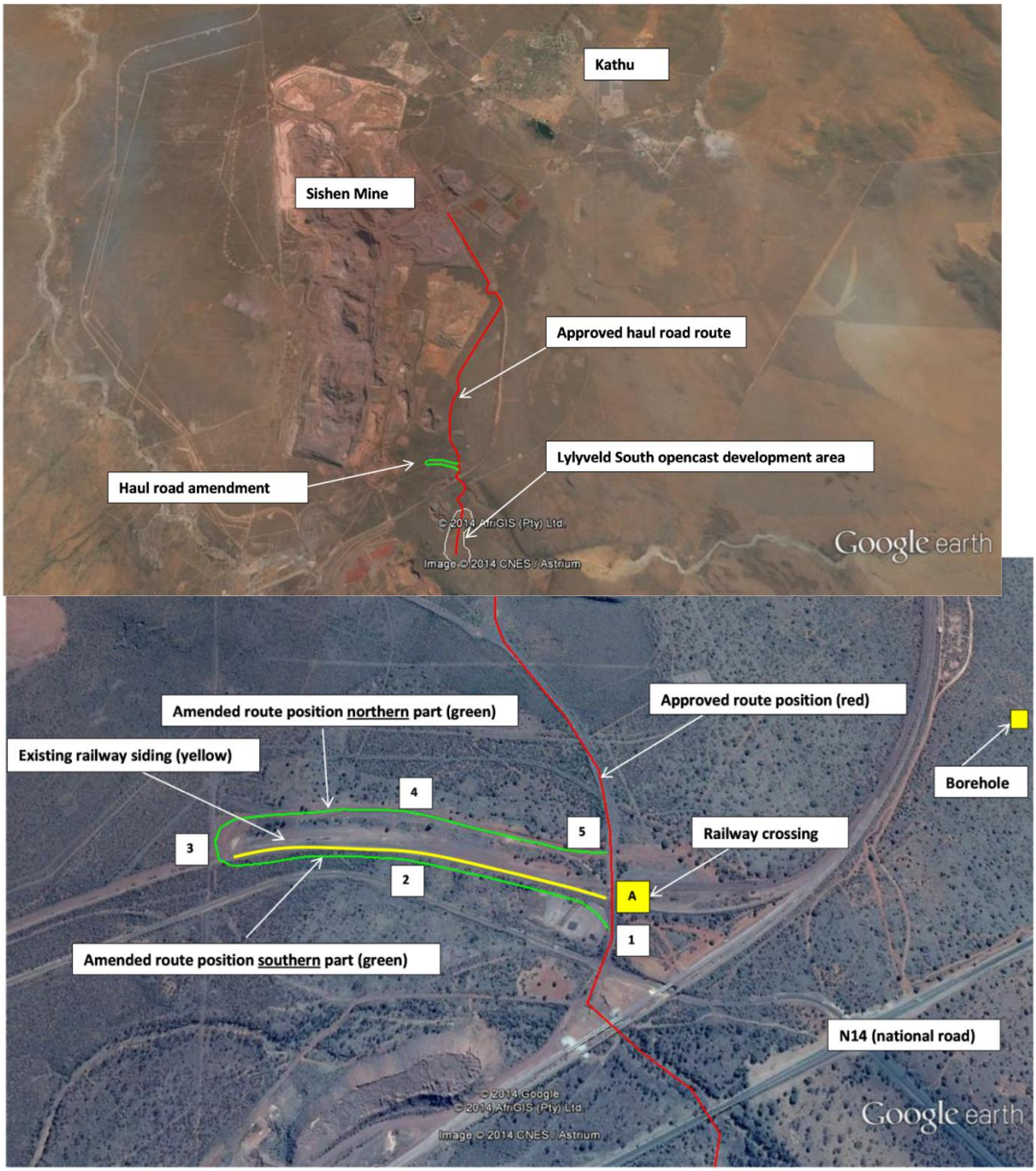


Figure 4: 2015 Approved Haul Road deviation on Sishen Mine

Figure 5: Current Lylyveld North haul road(treated with Dust-A-Side).

4. POLICY AND LEGISLATIVE CONTEXT

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLIY WITH AND RESPOND TO THE LEGISLATION AND POLICY CONTEXT.
National Environmental Management Act	DMR _ This application	Authorisation being applied for
National Environmental Management Waste Act	DMR _ This application	Authorisation being applied for
National Water Act	DWS - Approved	Water use licence granted (Please find attached Appendix E)
National Forest Act (Act 84 of 1998) Northern Cape Nature Conservation Act, No. 9 of 2009	DAFF	Permits have been obtained for removal of protected trees on Lylyveld. Any additional trees will be applied for if needed

5. NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES

5.1 Socio-economic value of the activity

The following information can be provided regarding the socio-economic value of the project:

Table 5: Capital Value of the activity

Action	Cost
Mobilization	R 100 000.00
Pit Waste Rock Dump Pushback	R 1 092 000.00
Lylyveld Haul Road Base Road	R 546 000.00
Lylyveld Haul Road Safety Berms	R 1 747 200.00

Lylyveld Road DAS (widening)	R 491 400.00
Lylyveld Road Fence (4 900m)	R2 139 190.34
Khumani Road De-bushing	R 165 110.04
Khumani Road Sand Removal	R165 110.04
Khumani Road Base Construction	R 709 800.00
Khumani Road Safety Berms	R 546 000.00
Khumani Road DAS (extension)	R 378 000.00
Khumani Road Security Fence (1800m)	R 2 130 612.00
Mining Cost	R 620 000 000.00
Hauling Cost	R 130 000 000.00
Plant Cost	R 50 000 000.00
Total Capital value	**R 814 210 232.08**

The expected Yearly Income from the project is estimated at R 228 857 142.00.

The following service infrastructure contribution will form part of the project:

- Security Fence of R 2 139 190.34
- Service Water of R 1 763 877.00
- Solar Lighting of R118 315.00
- Diesel generator of R 115 000.00

The total services contribution therefore is estimated at R 4 136 382.30.

5.2 Need and desirability of the activity

For Sishen mine to be able to reach their target of 360 000tons of ore it is necessary to access the 30m eastern pit wall pushback of the Lylyveld North Open Pit. This will lead to additional waste being created in the range of 1,480,000m^3. This will lead to additional space being required which is not currently available. Therefore it was decided that an expansion of the current waste rock residue dump is required.

The new Haul Road over Khumani's property is required to allow the mine to increase transport efficiency and to avoid interactions between heavy mining equipment (HME) and light vehicles. Currently Sishen mine needs to share the Transnet service road. This leads to two major problems, one being the safety of the Transnet workers that need to use the road and secondly the road is not wide enough to accommodate the Komatsu 795 trucks. It is also not preferred to have these large trucks on the same road as the Transnet personnel for safety reasons. With the construction of the extension over Bruce, the Transnet service road do not have to be shared between HME and light vehicles.

The road proposed also has less difficult and dangerous turns for the trucks.

The projects will lead to ongoing production resulting in the provision of jobs and generation of revenue to the region and the country as a whole.

5.2.1 Benefits for local communities

The Lylyveld North waste dump expansion and the proposed haul road extension will allow the mine to reach their targets required for ore abstraction, which in turn will lead to the continuation of the mine.

The Lylyveld projects have the potential to create an additional 33 jobs to the value of R5 940 000.000 per annum.

According to the Urban Econ Report for the Western Waste Rock Residue Stockpiles (WWRRS) in 2011, the SIOM employed 8 277 people of who 4 412 people were permanent employees and 3 865 were contract employees. Amongst the permanent employees, the greatest majority (about 54%) were semi-skilled and discretionary workers who in turn primarily comprised of plant and machine operators, whilst just slightly more than a third comprised of skilled technical workers and junior managers (Kumba Iron Ore Limited, 2011a). About 91% of permanent employees of the mine reside in the Gamagara Local Municipality (Kumba Iron Ore Limited, 2011e), which according to Labour Force Survey (StatsSA, 2009) had 8 636 employed people. Quantec (Quantec, 2012) suggested that the employment in the municipality increase to 9 792 people in 2010. Although employment statistics for 2011 is not available, given the above information it can be suggested that the mine absorbed about four out of ten employed people in the area, showing the prominent contribution thereof towards local employment.

The mine's contribution towards local employment though extends beyond that of direct employment. It also encompasses local employment that is created by the mine through procurement of local services and employment supported by expenditure of employees (both contract and permanent) of the mine within the local community. Considering the number of people employed in Gamagara, it can be suggested that most of the jobs created in the local municipality one way or another are dependent on the mine's operations and any decline in the mine's activities would result in a negative impact on the local employment situation if such direct activities are not off-set by respective production growth in other sectors of the local economy

Through production-induced and consumption-induced effects, the mine further supported 31 233 Full Time Equivalent (FTE) employment positions in 2011. Therefore, the total contribution of the mine towards employment in the country was 39 510 FTE jobs. Unless the production costs of the mine change, these positive employment impacts can be expected throughout the rest of the mine's operational life. Given that the economy employed about 13.6 million people in 2011 (StatsSA, 2011), it can be suggested that the mine contributed to the provision of work for about 0.2% of employed people in the country (Urban-Econ, 2012).

6. MOTIVATION FOR THE OVERALL PREFERRED SITE, ACTIVITIES AND TECHNOLOGY ALTERNATIVES

In the case of the proposed Waste Rock Residue Deposit expansion and the Haul Road extension developments, possible alternatives were identified through discussions with authorities, discussions with I&AP's, reviewing of existing environmental data, specialist inputs/studies and discussions with the client.

Some of the alternatives that were assessed include:

- Locality/Layout alternatives

- Technology alternatives

The preferred alternative for the Lylyveld North waste rock deposit is chosen to allow for the least impact from an environmental perspective as well as not sterilising any ore.

The preferred alternative for the haul road expansion will be the most direct and shortest route and would therefore have less of an impact.

7. FULL DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PROPOSED PREFERRED ALTERNATIVES WITHIN THE SITE

7.1 Details of the development footprint alternatives considered

In the case of the proposed Waste Rock Residue Deposit expansion and the Haul Road extension developments, possible alternatives were identified through discussions with authorities, discussions with I&AP's, reviewing of existing environmental data, specialist inputs/studies and discussions with the client.

Some of the alternatives that were assessed include:

- Locality/Layout alternatives
- Technology alternatives

7.1.1 Lylyveld North Dump Locality/Layout

Lylyveld North has an existing Waste Rock Residue Deposit. The dump was created in the 1980's. It has however become evident that additional dumping space needs to be created for approximately 1,480,000m^3 of waste rock. Various options were looked at from the engineering team to provide the best possible location for the expansion required.

The following options were taken into account:

1. Expansion to the South of the existing dump (Preferred)
2. Expansion to the North of the dump (Alternative 1)
3. Greenfields area for a new dump (Alternative 2)
4. Backfilling of waste (refer to technology alternative for discussion Section 7.1.2)

The Alternative 1 location was to the North of the existing dump. This would cover an area of 6.6 Ha (Refer to Figure 6). This alternative will lead to a bigger area being disturbed as well as more camel thorn trees requiring removal. It was on this basis that it was rather decided to proceed with the proposed expansion layout covering 5 ha as shown in Figure 3.

Alternative 2 would also require a larger area being disturbed as well as areas of high density camel Thorn trees that would have to be impacted on.

The best possible locality alternative therefore from a footprint and ecological impact point of view would be Alternative 1 as proposed.

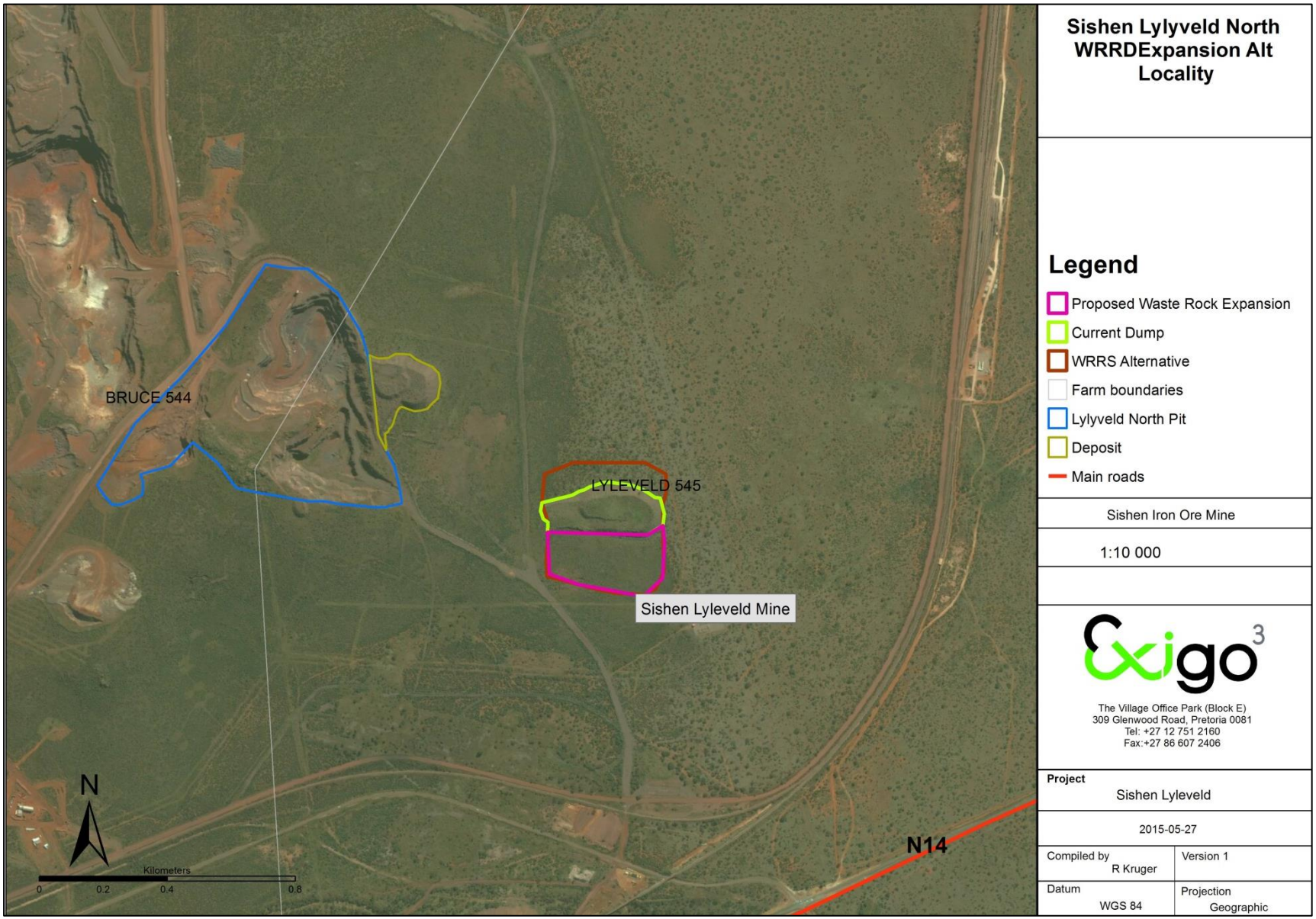


Figure 6: Locality alternative for the Lylyveld North Waste Residue Expansion

7.1.2 Lylyveld North Dump Technology (Backfill vs stockpiling)

During the initial design the option of backfilling was considered. The following problems were encountered, which made the alternative unfeasible:

- The waste will come from the 30m eastern pit wall pushback that is located on top of the ore to be mined.
- There is no current backfill opportunity within the current Lylyveld North Pit without sterilising ore. The iron ore is located at a depth, backfilling into this pit can only take place once all the ore is extracted

The proposed project as mentioned above in Section 1 (ii) is therefore preferred as this will allow the least impact from an environmental perspective as well as not sterilising any ore.

7.1.3 Lylyveld Haul Road Expansion

The original route alignment was approved by the Department of Environment and Nature Conservation in November 2009 as part of the Lylyveld South Project (Green line in Figure 7). A new road alignment was approved in May 2013 for an alternative route (purple line in Figure 7). SIOC has in the meantime negotiated with Assmang-Khumani mine and would like to construct the road over the Bruce property.

The following alternatives were investigated for the Haul road:

1. Preferred alternative over the farm Bruce
2. Alternative 1 (Previously approved alignment of 2009)
3. Alternative 2 (Current alignment which shares a portion with the Transnet Service Road - approved in May 2013)

Both Alternative 1 and 2 have areas where they are located on the Transnet Service road. As previously explained in Section 5.2 the Haul road cannot be expanded or stay on the Transnet Service Road due to various safety factors. It was therefore decided to negotiate with Khumani mine to obtain access over their property and propose the construction of a haul road on the Bruce property.

The preferred alternative for the Haul road expansion will also be the most direct and shortest route and would therefore have less of an impact on Ecology and Archaeology.

7.1.4 No Go Alternative

During the operational phase, the proposed project's greatest positive impacts are associated with the reaching of production targets at Sishen mine, which will ensure that current economic benefits to the community in the area of the mine are retained. Also an additional 33 jobs will be created. In the case of the no-go option, the targets will not be reached, which could in turn lead to jobs being lost instead of job creation.. Aside from the positive and most importantly prolonged impacts on export earnings, production,

value added, employment, household income, and government revenue, the residue deposits will be associated with negative effects as described in Section 10 which can mostly be mitigated to low or negligible.

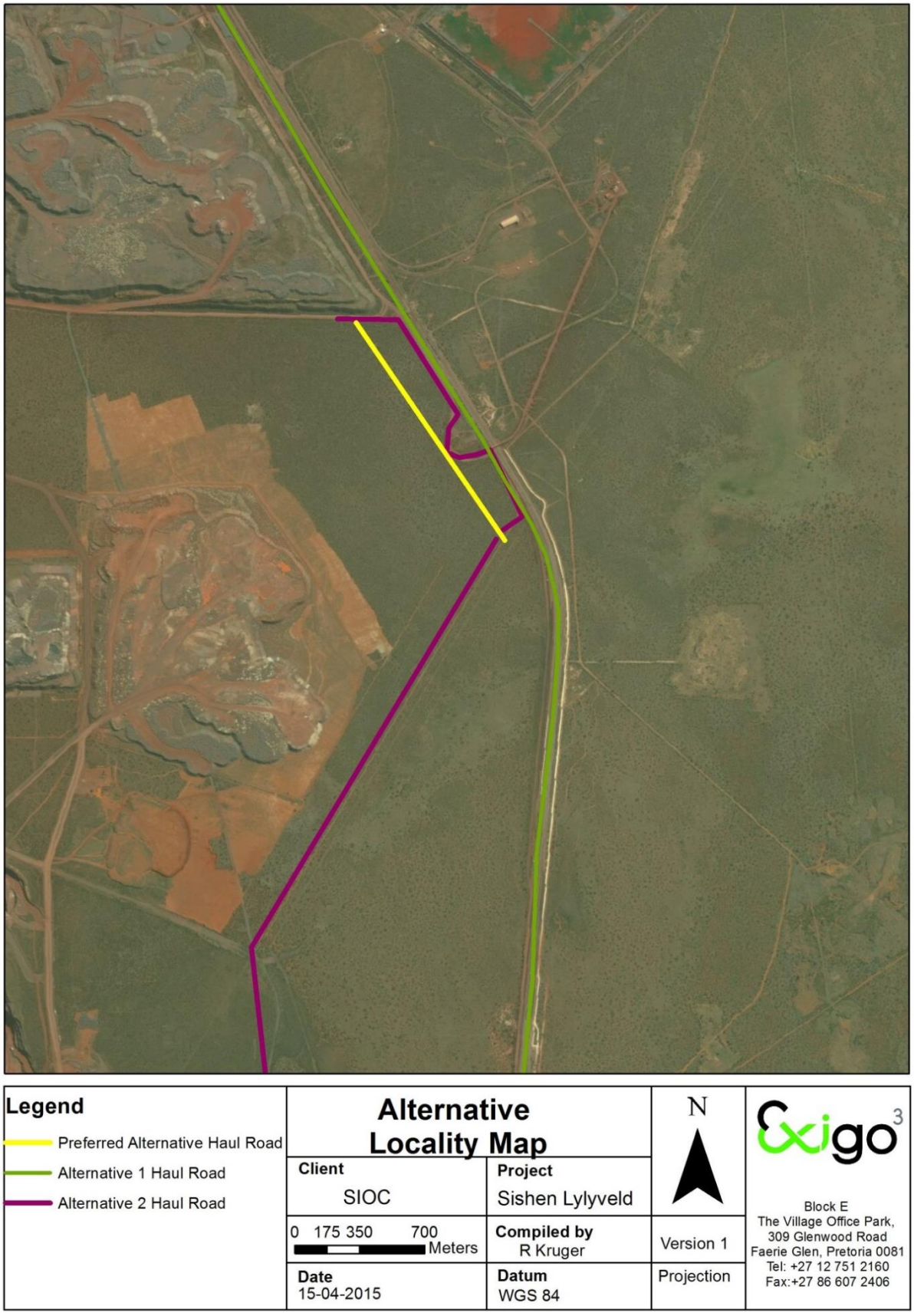


Figure 7: Locality alternative for the Lylyveld Haul Road Expansion

8. DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

The following process was undertaken to facilitate the public participation for the proposed project. This round included the review of the report and the notification of the project:

8.1 Newspaper Advertisement

A newspaper advertisement notifying the public of the application and BAR review process and requesting I&AP's to register their comments with Exigo, will be placed on the 5th of June 2015 in the Kathu gazette.

8.2 Site notice

In order to inform surrounding communities and adjacent landowners of the proposed development site notice boards were placed at the following locations on the 1st of June 2015:

- Khumani Mine entrance
- Sishen Mine entrance (Permit office)
- Foodzone
- Kathu Library

8.3 Direct Notification of Identified I&AP's

Key stakeholders, who included the following sectors, were directly informed of the proposed development by means of registered mail, faxes and emails on 1st of June 2015:

- The municipal councillor of the wards
- The Gamagara Local Municipality (John Taolo Gaetsewe District Municipality), which has jurisdiction in the area;
- The owners and occupiers of land adjacent to the site where the activity is or is to be undertaken
- The owners and occupiers of land within 100 metres of the boundary of the site or alternative site who are or may be directly affected by the activity; and
- Various organs of state having jurisdiction in respect of the activity

An Information notification letter with a Registration and Comment Sheet were distributed with the notification letter to all identified stakeholders from the 1st of June 2015.

The full database is shown in Table 6

8.4 Summary of issues raised by I&Aps

This report has been made available for public and other regulatory authority review in May 2015. All comments received will be collated into a Comments and Reponses Report, which will be submitted to DMR thereafter

Table 6: List of I&APs

Title, Name and Surname	Affiliation/ key stakeholder status	Contact details (tel number or e-mail address)	Tel	Fax	Cell	Mail	Notification Method
Esther	Department of Water Affairs	MakungoE@dwa.gov.za				P Bag X 313 Pretoria 0001	Email
Johan Burger	Gamagara Municipality - town planning officer	johannb@gamagara.co.za					Email
Cllr. Victor Gorrah	Ward councillor Ward 3 (site ward)	Civic Centre cnr of Hendrick van Eck and Frikkie Meyer Road Kathu 8446			071 541 4162		courier
Cllr. G Vos	Ward councillor Ward 1 (next to site)	Civic Centre cnr of Hendrick van Eck and Frikkie Meyer Road Kathu 8446			082 801 1844		courier
Cllr H du Plessis	Ward councillor Ward 1 (next to site)	Civic Centre cnr of Hendrick van Eck and Frikkie Meyer Road Kathu 8446			071 802 8415		courier
Cllr. P Selonyane	Ward councillor Ward 5 (next to site)	Civic Centre cnr of Hendrick van Eck and Frikkie Meyer Road Kathu 8446			081 856 6967		courier
Clement Itumeleng	Gamagara Local Municipality, Municipal Manager	clementi@gamagara.co.za	053 723 2261/ 6000	053 723 2221	073 803 1783	PO Box 1001, Kathu, 8446	Email
Sylvia Lucas	Northern Cape Department of Environmental Affairs and Nature Conservation	slucas@ncpg.gov.za	053 832 1022	053 832 1026		Private Bag X6010, Kimberly, 8300	Email
Ncedisa Mahala	Department of Mineral Resources	Ncedisa.Mahala@dmr.gov.za					Email

Mrs V Manong	Kuruman District Municipality Health Officer	vmanong@kur.ncape.gov.za	053 712 0775	053 712 0656		Private Bag X910, Kuruman, 8460	Email
Jacoline Mans	Department of Forestry	JacolineMa@daff.gov.za	054 338 5800	054 334 0205		Private Bax X5912 Upington 8800	Email
Dr FM Lucky Mathebuila	Economic Development Specialist and Advisor to National Government - Pretoria.	mathebula@yebo.co.za					Email
Ms J Meyer	Development Planning, Provincial Support.	jmeyer@ncpg.gov.za	0538025108	0866200426	0716873540	Office of the Premier, Templar Building, 6th Floor, Kimberley, 8530	Email
Vijoen Mothibi	Department of Agriculture, Land Reform and Rural Development	cfortune@agri.ncape.gov.za	053 838 9118	053 831 3635			Email
Mr O Phiri	Moshaweng Local Municipality	tmtlhoaele@yahoo.com	053 773 6001		053 773 6007		Email
Molodi Rakoi	Gamagara Local Municipality (Mayor)	mayorg@gamagara.co.za	053 723 2261	053 723 2021	082 889 3158	PO Box 1001, Kathu, 8446	Email
Manager	Khara Hais Municipality	manager@kharahais.co.za					E-Mail
Des Brasington	Atlantic Renewable Energy Partners (Pty) Ltd	desbras@vodamail.co.za; des@farmbrokers.co.za	082-77 92 087	086-539 5617			Email
David Peinke	Atlantic Renewable Energy Partners (Pty) Ltd	david@atlanticep.com	084-401 9015	086-514 8184			Email

Dirk Coetzee	Assmang Ltd	dirk.coetzee@assmang.co.za	053 723 8090		083 459 7580		Email
Alex Mostert	Assmang Ltd	alexm@assmang.co.za	053 563 2103	086 563 2103		Private Bag X503, Kathu, 8446	Email
Tania Anderson	WESSA: NC Conservation	spothil@gmail.com	053 839 2713	053 842 1433		PO Box 316, Kimberly, 8300	Email
Badie Badenhorst	Agri Northern Cape	ncagric@worldonline.co.za	053-832 9595/204 0036	053-832 7126			Email
Judi Bolwez	Kathu Gazette	editor@kathugazette.co.za	053 723 2000	086 531 7438	082 475 0633		Email
Johan Botha	Boegoeberg Water User Association	ceowua@boegoebergwater.co.za	054-841 0002	086-575 6443			Email
Willie Bruwer	Orange Vaal Water User Association	aqua@douglas.co.za	082-575 6828	053-298 1262			Email
Stephanie Cornelissen	Wright 538, ptn 0	wright@polka.co.za	053 724 2129	053 724 2129	082 922 4627	Posbus 170, Kathu, 8446	Email
Andre de Villiers	Reverend of NG Kerk, Kathu	andre@ngkathu.co.za	053 723 4896	086 675 2464	084 679 3274		Email
De Villiers	Water Users Association & Octagonal Development CC.	erika@octagonal.co.za;			082 542 8842		Email
Denise Eiliers	Gamagara High School	gamagarahs@gmail.com	053 791 0320				Email
Suzanne Erasmus	WESSA Northern Cape c/o McGregor Museum	wessanc@yahoo.com ; wessanc.conservation@yahoo.com	0538392717	0538421433	0828497655	PO Box 316; Kimberley. 8300	Email
Collin Fortune	McGregor Museum	cfortune@museumsnc.co.za	053-839 2701	053-842 1433			Email

Hennie / Hester Magrieta / Dawid Hermanus Fourie	Bishopswood ptn 2	hennie@electri-city.co.za					Email
Nico	Fourie	ngc@mtnloaded.co.za					Email
Gerhard Leibbrandt	Chief Administrative Official Transnet Freight Rail (Infrastructure)	Gerhard.Leibbrandt@transnet.net	011 773-2706				Email
Louis Hauman	Agri Kuruman	louis@soetvlakte.co.za	053 751 1631	083 251 5334			Email
Jaap Hoffman	Parsons 564, ptn 4	jaap.hoffman@angloamerican.com	053 193 1977		082 572 0732		Email
Shawn Johnston	Process Specialist, Sustainable Futures ZA	swjohnston@mweb.co.za		0865102537	0833259965		Email
Mr D Maleke	Sedibeng Water: Communication Officer	dmaleke@sedibengwater.co.za	053 773 1009	053 7736 1221		PO Box 386, Mothibistad, 8474	Email
Abrie Maritz	Curtis Boerdery CC	maritzsiviel@vodamail.co.za	053 723 2029	053 723 2029	082 926 9670	Posbus 1656 Kuruman 8446 and Kalkstreet 10, Kathu	Email
Alfred Markram	Moria Boerdery cc	amarkram@tramirloc.co.za / amarkram@gmail.com			0839984001		Email
Clive Moses	National Development Agency	clivem@nda.org.za	053-831 4828	053-831 4824			Email
Mr Livhuwani Wilson Ndou	Transnet Freight Rail – Risk Department: Environmental Specialist	Livhuwani.Ndou@transnet.net	0514082939	0514084487	0832789499	6 du Toit Ave, Harmona, Bloemfontein, 9301	Email
Kallie Page	NG Kerk	kallie.page@angloamerican.com					Email

Annette Smit	Sanyati Guest House	annette@sanyatibb.co.za					Email
André Swart	DALR & RD	aswart@agri.ncape.gov.za	053-839 7800	053-839 7880			Email
Albertus Viljoen	Tshiping Water user Association	info@tshiping.co.za	0533130595	0533130595	0836495452	PO Box 434, Postmasburg, 8420	Email
Moses Ramakulukusha	DENC	mramakulukusha@yahoo.com					Email
Ntsundeni Ravhugoni	DMR	Ntsundeni.Ravhugoni@dmr.gov.za					Email
Raisibe Sekepane	DMR	Raisibe.Sekepane@dmr.gov.za					Email

9. THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE ALTERNATIVES

9.1 Type of environment affected by the proposed activity

9.1.1 Regional setting

The project area is located in the Northern Cape Province, ~230 km northeast of the town of Upington and 280 km northwest of the town of Kimberley and 7.5 km from the town of Kathu (Figure 1). The layout plan for the proposed dump expansion and haul road extension is indicated in Figure 3 and Figure 6 respectively.

9.1.2 Vegetation

A site visit was conducted by Dr. Buks Henning from Exigo on the 10th of March 2015. The report with findings is attached as Appendix C 1.

The development site lies within the Eastern Kalahari Bushveld Bioregion of the Savanna biome which is the largest biome in Southern Africa. A biome is a broad ecological unit that represents a major life zone extending over a large natural area, and reflects the major features of climate (Rutherford & Westfall 1994).The Savanna Biome is characterized by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). The environmental factors delimiting the biome are complex and include altitude, rainfall, geology and soil types, with rainfall being the major delimiting factor. Fire and grazing also keep the grassy layer dominant.

Acocks (1988) classified the vegetation around Sishen as subdivisions of the Vryburg Shrub Bushveld (VT 16b (1&2), Acocks 1988). Recent revisions of the vegetation types of South Africa describe the vegetation around Sishen as Kalahari Plains Thorn Bushveld (VT30, van Rooyen & Bredenkamp 1996) with Kalahari Plateau Bushveld (VT33, van Rooyen & Bredenkamp 1996) to the east of the Sishen farms.

The most recent classification of the vegetation types in the study area by Mucina & Rutherford (2006) indicates that the project area forms part of the Kathu Bushveld vegetation type (haul road extension) and Kuruman Thornveld (dump expansion site). Table 7 indicate the general characteristics of this vegetation type.

Table 7: Characteristics of the Vegetation Types of the study area

Vegetation types (Mucina & Rutherford, 2006)	**Kathu Bushveld**	**Kuruman Thornveld**
Vegetation & Landscape characteristics	The vegetation and landscape characteristics include a medium-tall tree layer with dense stands of Acacia erioloba in places, but mostly an open woodland with *Boscia albitrunca* as the prominent tree species, while the shrub layer is dominated by *Acacia mellifera, Lycium hirsitum* and *Diospyros lycioides*. This vegetation type in its pristine state is characterized by plains with layer of scattered, low to medium high deciduous microphyllous trees and shrubs with a few broadleaved tree species, and an almost continuous herbaceous layer dominated by grass species.	Flat, rocky plains and some sloping hills with very well developed, closed shrub layer and well developed open tree starum of *Acacia erioloba*.
Conservation status	Least Threatened conservation status, with 1% transformed and none statutorily conserved	Least Threatened conservation status, with 2% transformed and none statutorily conserved

The vegetation communities identified on the proposed development site are classified as physiographic physiognomic units, where physiognomic refers to the outer appearance of the vegetation, and physiographic refers to the position of the plant communities in the landscape. The physiographic-physiognomic units will be referred to as vegetation units in the following sections. These vegetation units are divided in terms of the land-use, plant species composition, topographical and soil differences that had the most definitive influence on the vegetation units. Each unit is described in terms of its characteristics and detailed descriptions of vegetation units are included in the following section. The following vegetation units were identified during the survey as indicated in Figure 8 for the haul road extension site, while the vegetation units for the dump expansion site are indicated in Figure 9

1. *Tarchonanthus camphoratus* shrubveld;
2. Mixed *Tarchonanthus – Ziziphus – Searsia ciliata* bushclumps;
3. *Acacia mellifera – Tarchonanthus camphoratus* shrubveld;
4. *Acacia erioloba – Tarchonanthus camphoratus* woodland (also known as natural woodland)
5. *Acacia mellifera* woodland (old prospecting sites).

For more detail on each of the units please refer to Appendix C 1 Specialist Studies

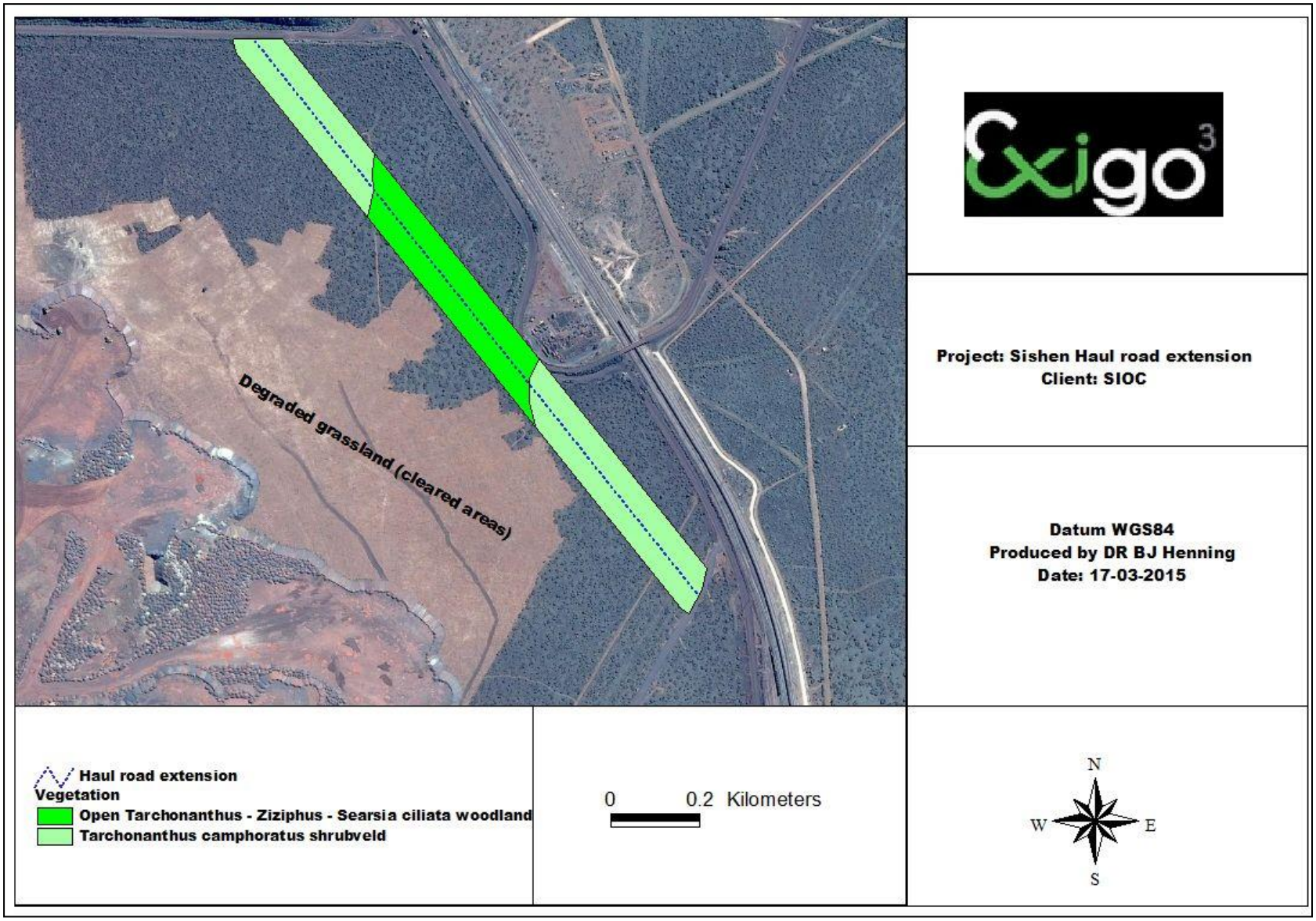


Figure 8: Vegetation Map of the proposed haul road extension area

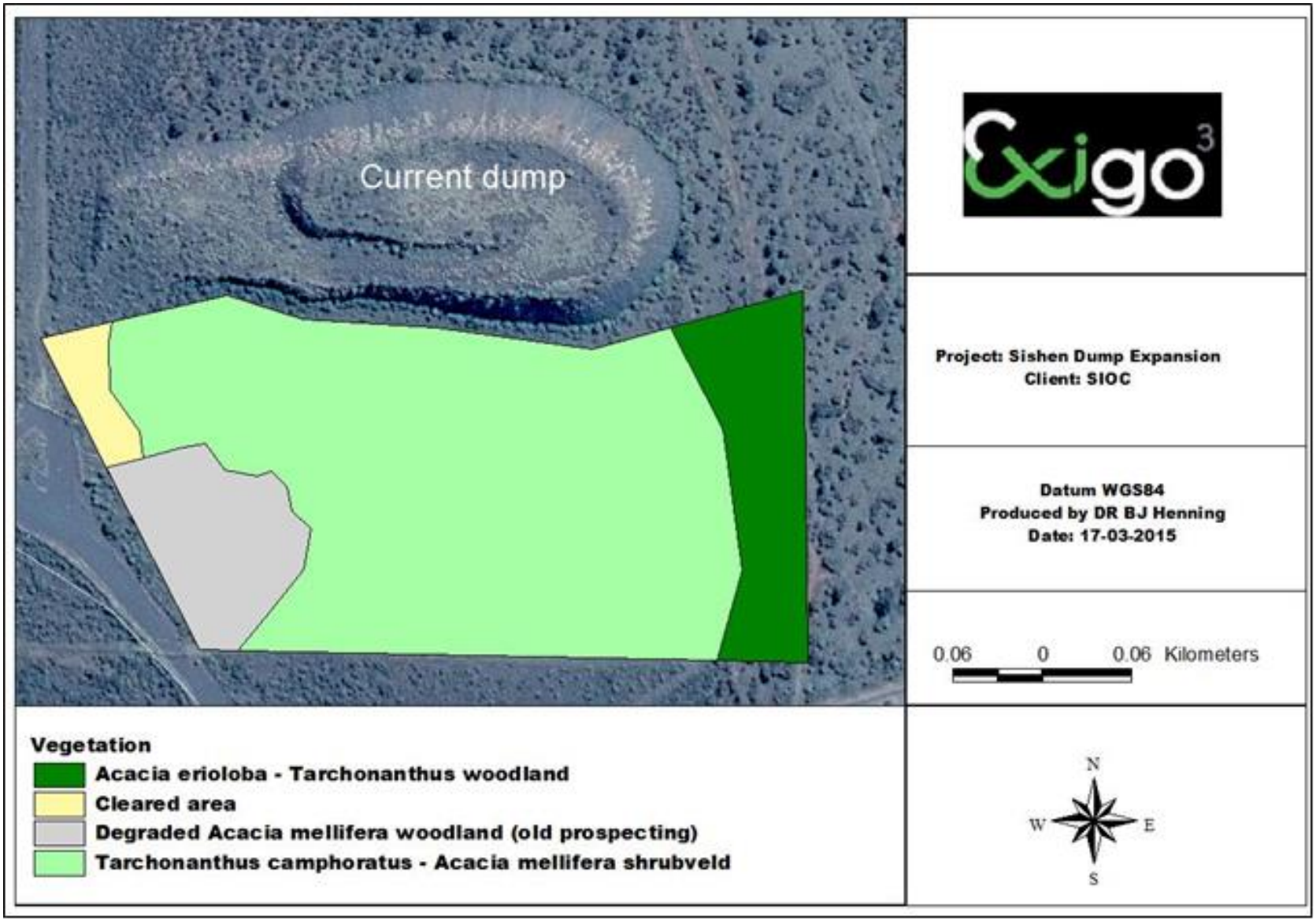


Figure 9: Vegetation Map of the proposed Dump Expansion area

9.1.3 Geology and soil types

Geology is directly related to soil types and plant communities that may occur in a specific area (Van Rooyen & Theron, 1996). A Land type unit is a unique combination of soil pattern, terrain and macroclimate, the classification of which is used to determine the potential agricultural value of soils in an area. The land type unit represented within the proposed footprint area include the Ag110 land type (Land Type Survey Staff, 1987) (ENPAT, 2000). The land type, geology and associated soil type is presented in Table 8 below as classified by the Environmental Potential Atlas, South Africa (ENPAT, 2000).

Table 8: Land types, geology and dominant soil types of the proposed development site

Land type	Soils	Geology
Ag110	Red-yellow apedal, freely drained soils, red, high base status, < 300 mm deep	Surface limestone, alluvium and red wind-blown sand of Tertiary to Recent age with a few occurrences of amygdaloidal andesitic lava (Ongeluk Formation).
Ae12	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	Red to flesh-coloured wind-blown sand with outcrops of shale, flagstone, quartzite and conglomerate (Gamagara Formation).

The geology of the general area comprises red aeolian sand (Gordonia Formation, Kalahari Group) that forms part of the Kalahari and what is now considered to be a fossil desert. The red sands of the Kalahari are often underlain by calcrete of Tertiary to Recent age which in turn overlies andesitic or basaltic lava of the Ventersdorp Group (Visser, 2006). The soils on the proposed development site varies from being shallow calcareous soils (western section) to deeper Hutton soil form where the sand is deeper and the calcrete is not near or at the surface.

9.1.4 Hydrology and drainage

The project area is situated within the quaternary catchment D41J, which is located in the Lower Vaal WMA. There are no perennial rivers in the area. The local quaternary catchment D41J covers an area of 3 847 km^2. The catchment system is endoreic with the Gamagara River flowing into the Kuruman River close to Hotazel. The Kuruman River flows into the Molopo River at Andriesvale south of the Kalahari Gemsbok Park. From there, the Molopo flows into the Abiekswasputs pans north of the town of Noenieput.

9.1.5 Baseline Water Quality

All groundwater quality monitoring data for Sishen mine from October 2003 to April 2014 was received from Aquatico Scientific (2014), who is conducting the water quality monitoring for Sishen.

Only current [1]groundwater monitoring points that could assist in determining the leach possibility of the mine residue were used in this survey. Boreholes downstream of the existing residue dumps are included in those boreholes being currently monitored.

A table of the groundwater monitoring points used in the analysis are provided in Table 9. The locations are shown in Figure 10.

Table 9: Sishen groundwater monitoring points used

Site Name	Latitude	Longitude	Description
Sekgame 08	-27.766290	23.071113	Upstream of HEF Plant - Sekgame Farm
SW465	-27.769478	23.003152	Sishen Extraction Borehole - Slope Area
SW466	-27.769317	23.003258	Sishen Extraction Borehole - Slope Area
SW467	-27.769087	23.003208	Sishen Extraction Borehole - Slope Area
SW495	-27.744177	22.966967	Sishen Extraction Borehole - Dingleton
SW497	-27.723152	22.960023	Sishen Extraction Borehole - Dingleton
SW529	-27.768350	22.995970	Extraction borehole
SW547	-27.743943	23.028678	Tailings
SW577	-27.760275	23.003568	Sishen Extraction Borehole - G35
SW586	-27.738500	22.988740	Extraction borehole
SW601A	-27.736150	22.982690	Extraction borehole
SW613	-27.739205	23.019695	Loading station
SW614	-27.738665	23.019290	Loading station
SW692	-27.733015	22.981377	Extraction borehole

[1] Current is defined as all monitoring points for which data exist for the year 2014

SW776	-27.755990	23.041217	Sw776 - Hef Plant
SW778	-27.754990	23.036768	Sw778 - Hef Plan
SW783	-27.760600	23.039700	Hef Groundwater Remediation Boreholes
SW830	-27.756482	22.995257	Extraction borehole
SW835	-27.715612	22.963987	Extraction borehole

Monitoring boreholes SW835, SW465, SW466 and SW467 are directly downstream of mine residue dumps. Boreholes Sekgame 08, SW495 and SW497 can be viewed as background, as they are upstream of the mine residue and other facilities in terms of groundwater flow direction.

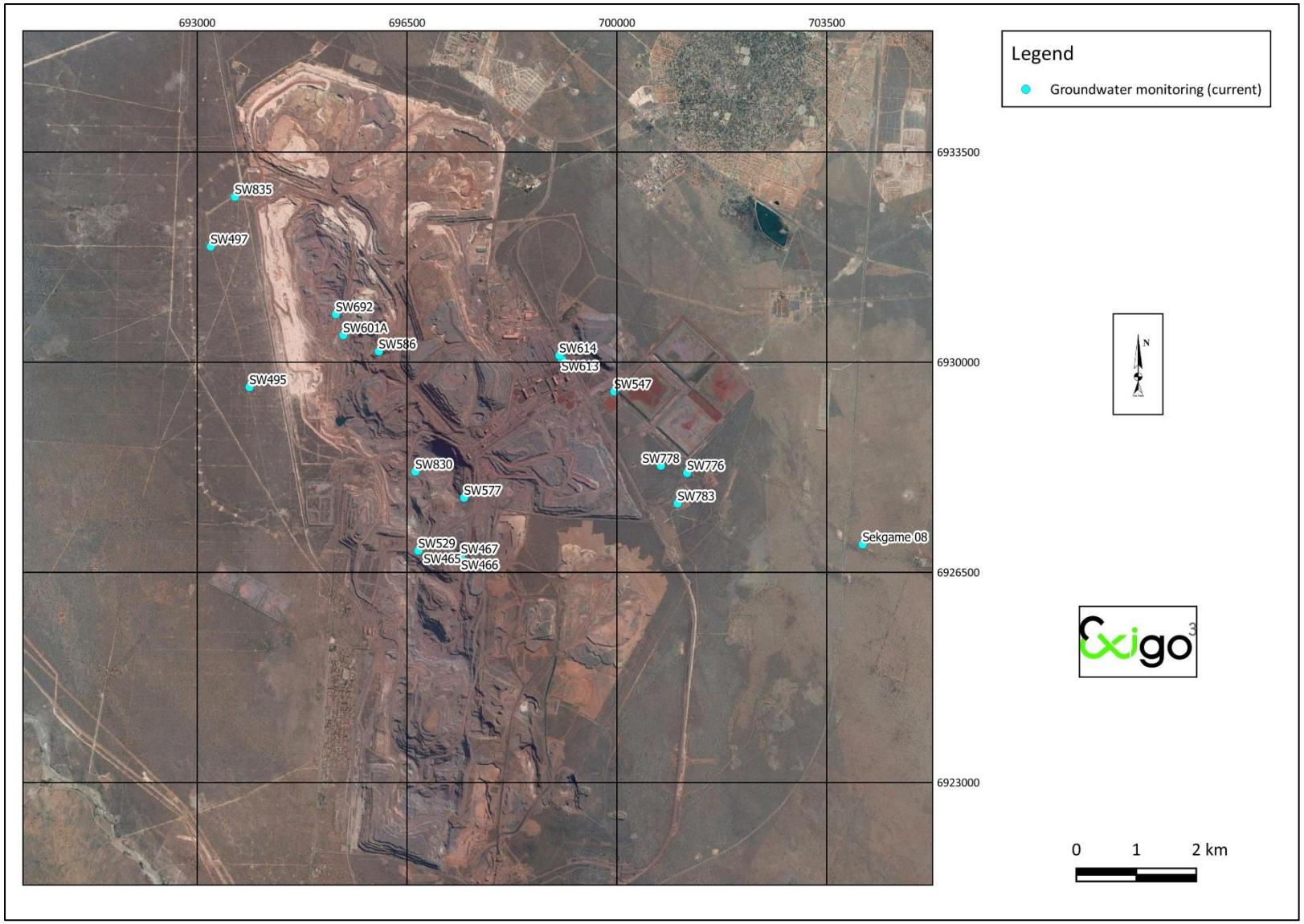


Figure 10: Groundwater monitoring points

A Piper diagram is a tri-linear diagram of the major dissolved cations and anions in water samples in milli-equivalents per litre (meq/l). This diagram is useful to classify water samples and to compare trends in the macro chemistry, especially for large quantities of samples. A Piper diagram of the latest groundwater and surface water quality monitoring data shows that the groundwater is mostly of a calcium-magnesium-bicarbonate type (Figure 11).

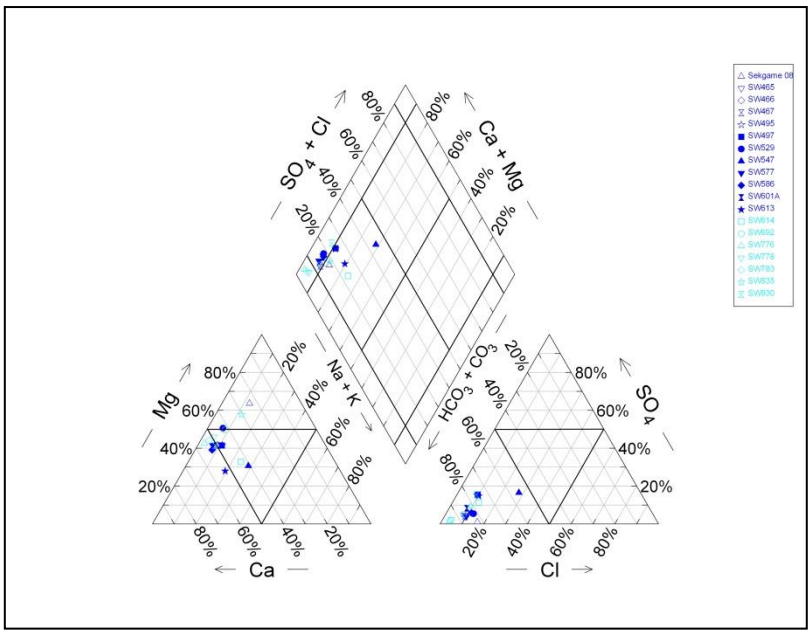


Figure 11: Piper diagram of the latest groundwater and surface water monitoring results

The predominance of calcium and magnesium cations and the bicarbonate anion are indicative that the groundwater regime in the project area is dominated by the dolomitic rocks of the Ghaapplato and other calcareous formations.

A Durov diagram is a modified Piper diagram showing total dissolved solids (TDS) and pH as well. The Durov diagram of the Sishen groundwater (Figure 12) shows that the TDS is < 900 mg/l for all samples and the pH is > 7.0 for all samples. Metal concentrations are generally low at neutral to alkaline pH values.

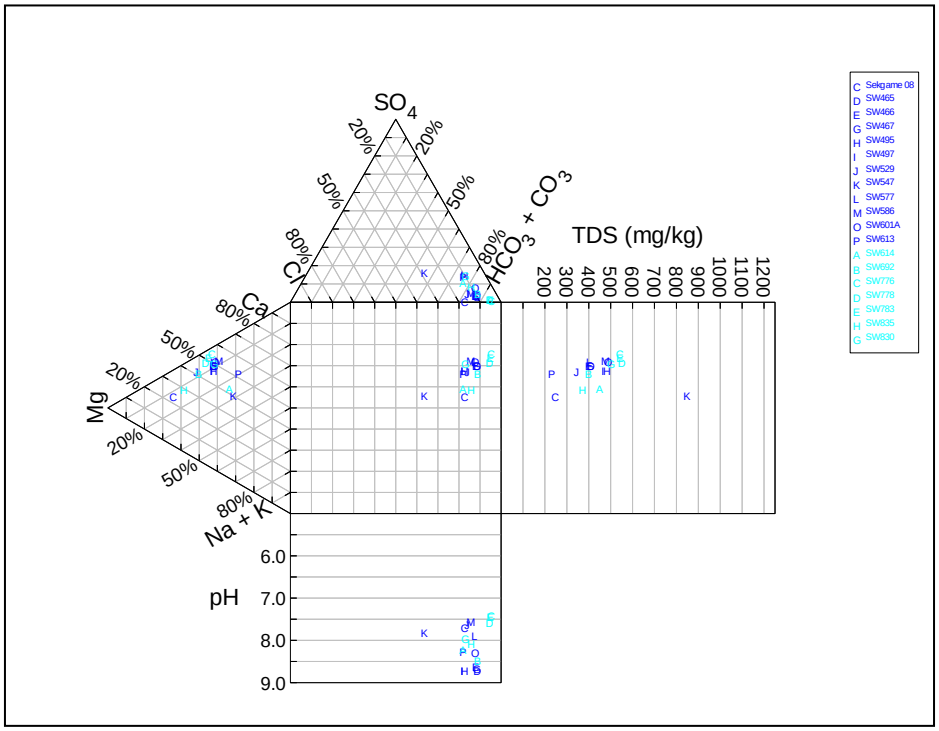


Figure 12: Durov diagram of Sishen groundwater monitoring data

From the analysis of the current groundwater quality as part of the waste rock classification report done by Exigo in 2014 the following summary can be derived. The analysis of groundwater monitoring shows that the background groundwater, i.e. upstream of the waste rock facilities and mining activities, only shows elevated lead and manganese concentrations for some boreholes and none of the groundwater monitoring points downstream of the existing rock residue dumps exceed both the background and SANS drinking water guideline values. The elevation of lead and manganese however is due to natural occurrences and is not due to leachate from the mine residue material as was confirmed by the leachate and total analysis results (Exigo, 2014).

9.1.6 Climate

The regional climate is semi-arid with a mean annual precipitation of 374 mm/a. The precipitation tends to fall in summer and early autumn. Temperatures vary between –9°C and +42°C, with an average of 19°C.

9.1.6.1 Rainfall

The mean annual precipitation (MAP) of the Sishen Mine is 374 mm/a. Figure 13 shows the MAP as measured at from 1963 to 2011.

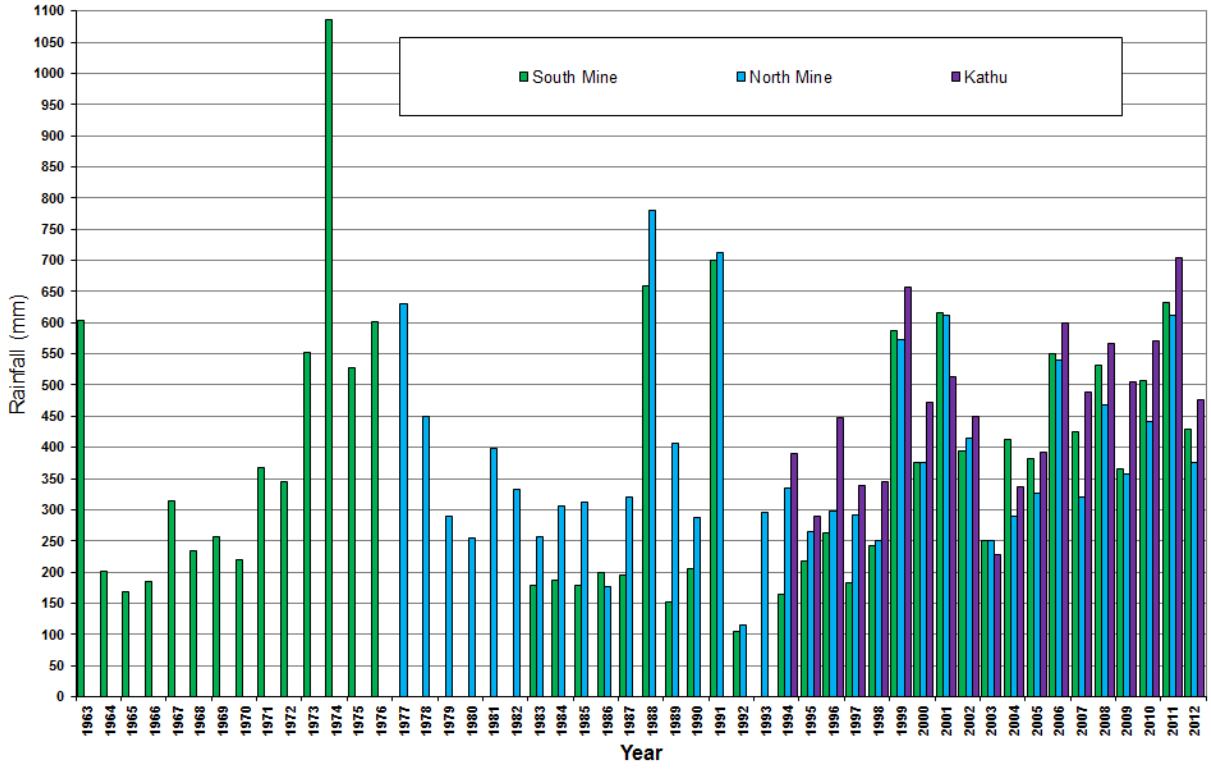


Figure 13: Annual rainfall for Sishen Mine and Kathu (SIOM, 2012).

9.1.6.2 Temperatures

The mean annual temperature at the Sishen Mine is 19^{O}C. The average annual maximum temperature is 26,7^{O}C and minimum temperature is 11,8^{O}C. January is the warmest month with an average maximum temperature of 32,9^{O}C and July is the coldest month with an average minimum temperature of 3,1^{O}C. The mean monthly temperatures at Sishen Mine are tabled below (Table 10).

Table 10: Average Monthly Temperatures at Sishen Mine

	Ave.	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sep
Minimum (^{O}C)	**11,8**	13,2	16,0	17,8	19,0	18,3	16,3	12,2	7,3	3,6	3,1	5,3	9,7
Maximum (^{O}C)	**26,7**	28,5	30,7	32,4	32,9	31,4	29,4	25,7	22,3	19,0	19,6	22,0	26,0
Source: Sishen Weather Station (Station No. 0356857AX) 1961 to 2001.													

9.1.6.3 Evaporation

The average annual evaporation rate in the region is 2 026 mm per year, which is more than 5 times greater than the mean annual precipitation, which is 374 mm per year.

9.1.6.4 Wind Direction and Speed

At Sishen mine the prevailing wind direction is from the northwest and the southeast. The strongest winds are from northwest. During the day the prevailing winds are from the northwest with limited airflow from the southeast. Daytime airflow is characterised by higher occurrence of strong winds of more than 5 m/s. There is an increase in the number of calm conditions during the night; from 7.2% (daytime) to 12.6% during the night. The wind velocity also decreases significantly and the airflow changes to be predominantly from the southeast during the night (Figure 14) (WWRRS, 2012).

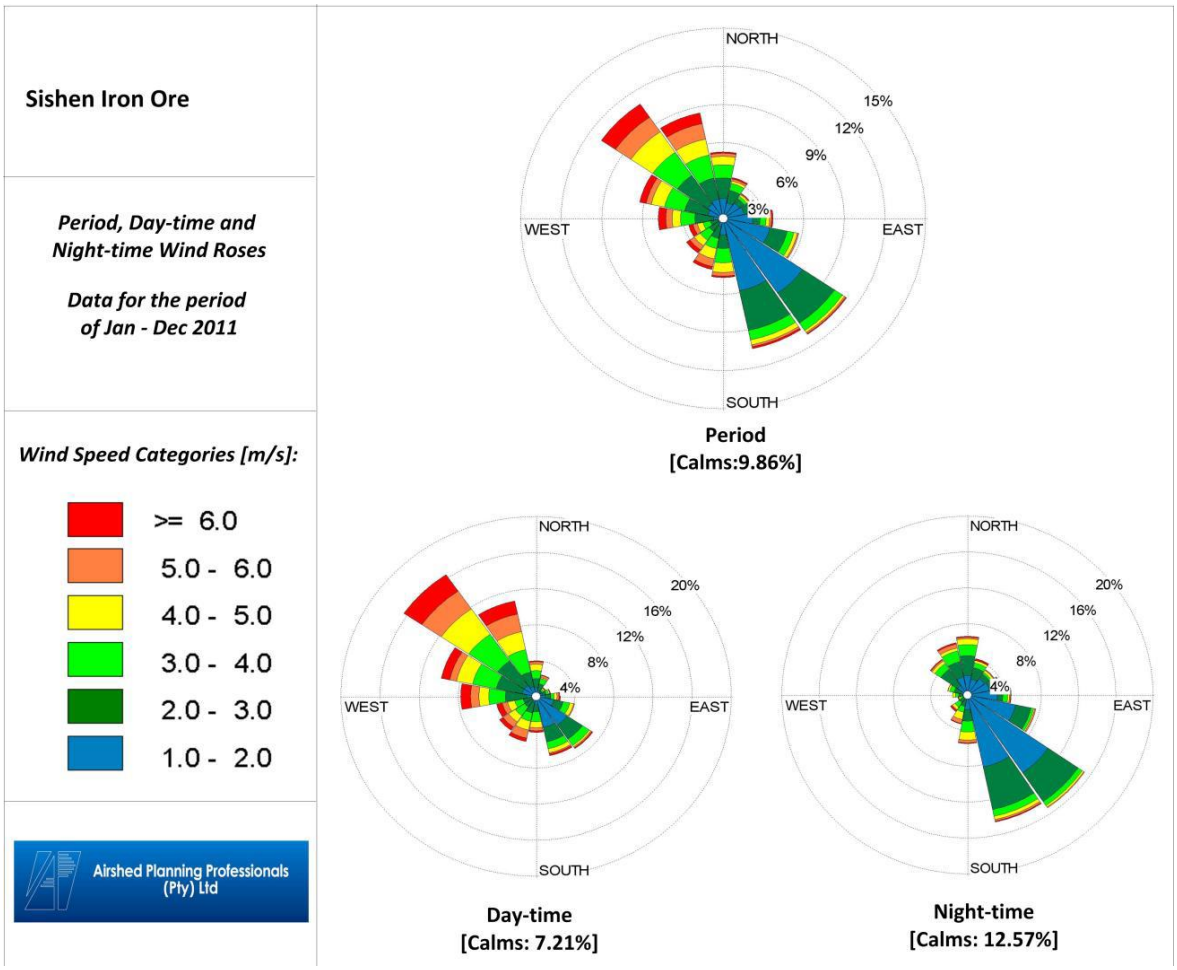


Figure 14: Period, daytime and night-time wind directions recorded at Sishen Mine (Airshed, 2012).

9.1.7 Air Quality

Sishen Mine operates an ambient monitoring (PM10) and dust fallout (deposition) network. The focus of the results presented here is for the three sensitive receptor areas around the mine, namely Dingleton, Sesheng and Kathu.

9.1.7.1 PM10 Data from the Ambient Network at Sishen

Since July 2011 Sishen Mine monitors the ambient PM10 levels at the three residential areas, Dingleton, Sesheng and Kathu by means of Beta Attenuation Mass (BAM) monitors. The annual average concentrations for the period 2011 (Q3 & Q 4), 2012 (Q1 – Q4), 2013 (Q1

_Q4), 2014 (Q1- Q4) and 2015 (Q1) as measured with the BAM monitors are shown in the graphs below. (Figure 15, Figure 16 and Figure 17).

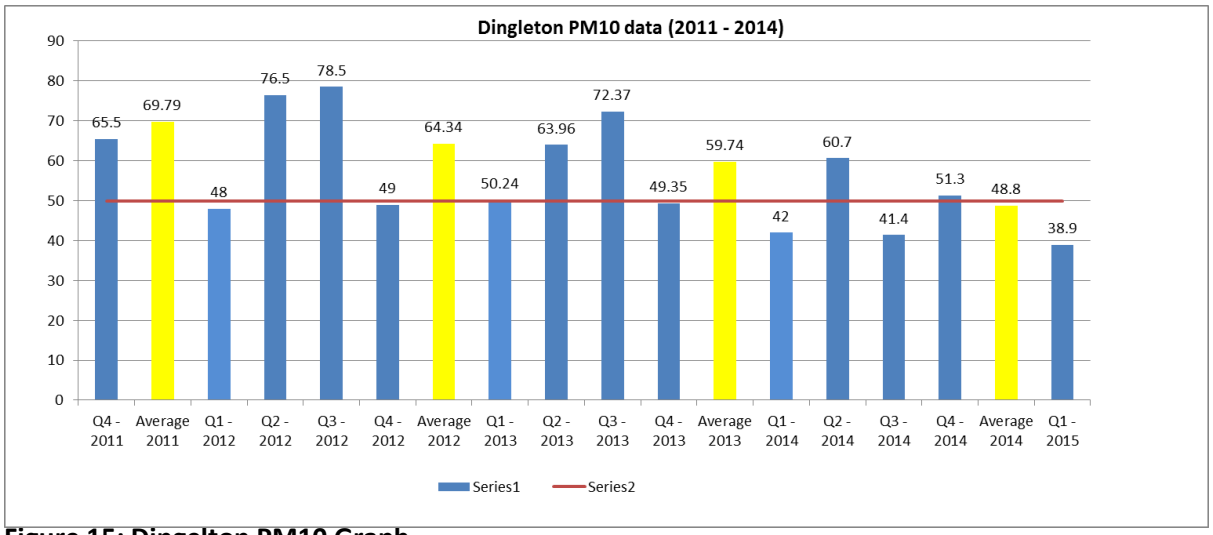


Figure 15: Dingelton PM10 Graph

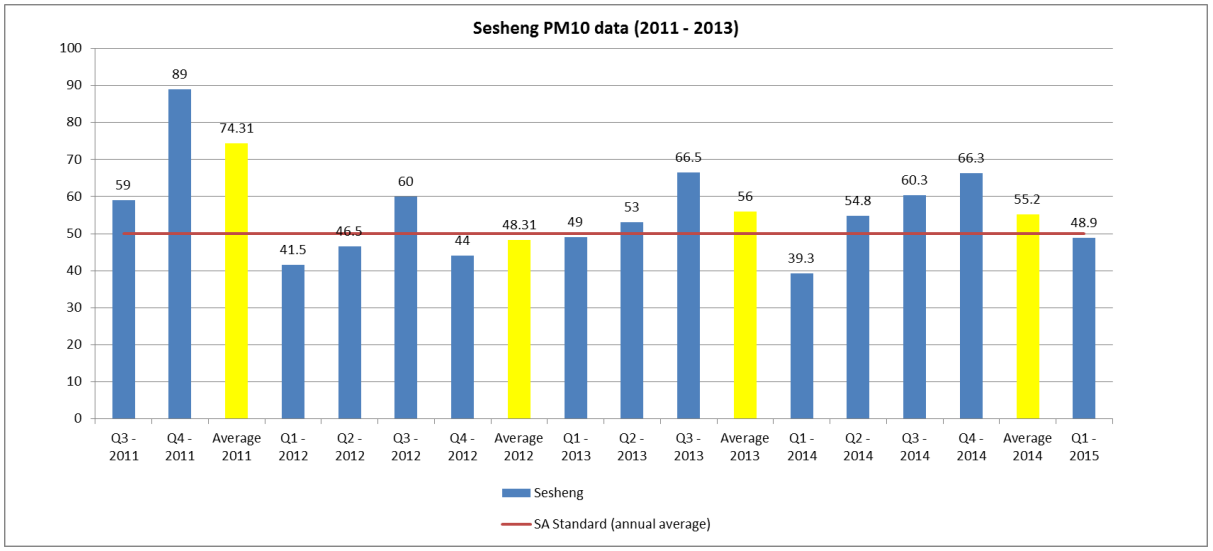


Figure 16: Sesheng PM10 Graph

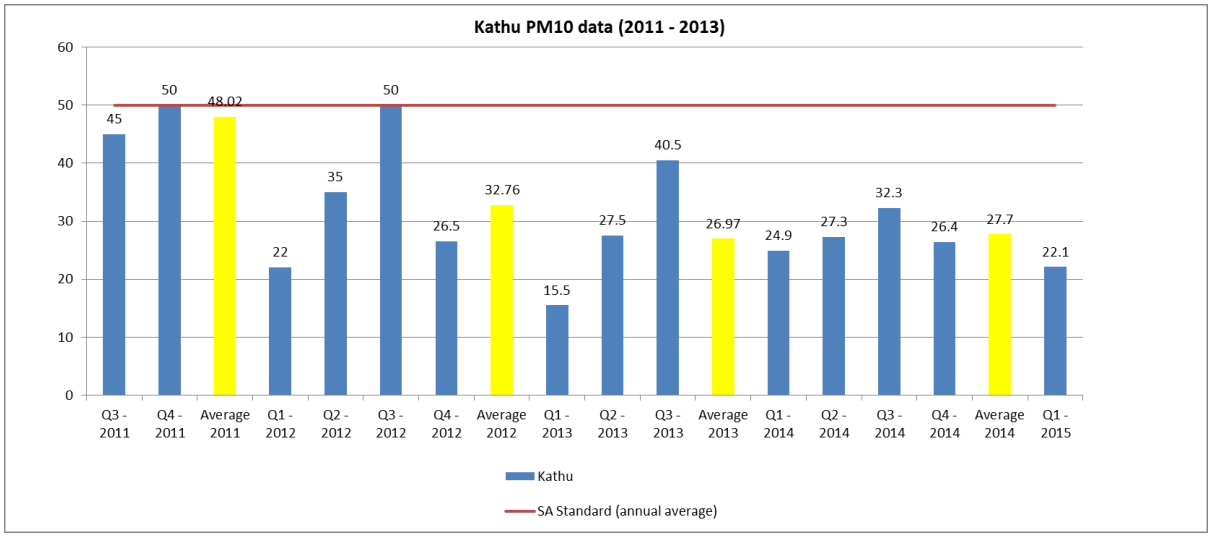


Figure 17: Kathu PM10 Graph

The following is evident from the above graphs:

- The average concentration measured at Dingleton in 2011 was 69.79µg/m^3, in 2012 this decreased to 64.34 µg/m^3 in 2013 to 63.09 µg/m^3 with a further decrease in 2014 to below the National Ambient Air Quality Standard (NAAQS) limit to 48.8 µg/m^3. The Q1 of 2015 also showed a drastic reduction to 38.9 µg/m^3.
- The average concentration measured at Sesheng in 2011 was 74.31µg/m^3, in 2012 this decreased to 48.02 µg/m^3, in 2013 increased again to 56 µg/m^3 and in 2014 decreased again to 55.2 µg/m^3. The Q1 of 2015 showed a below limit detection of 48.9 µg/m^3.
- The average concentration measured at Kathu in 2011 was 48.02µg/m3, in 2012 this decreased to 32.76 µg/m^3, in 2013 decreased again to 26.97 µg/m^3, in 2014 the average increased to 27.7 µg/m^3 still below the limit. The Q1 of 2015 showed a below limit detection of 22.1 µg/m^3.

Overall a reduction in PM 10 emission can be seen due to various mitigation measures being implemented by Sishen mine.

9.1.7.2 Dust fallout

Dust fallout monitoring is taking place at various locations on and around the mine. The mine's dust fallout monitoring localities are indicated in Figure 18. Annual average dust fallout results for the period 2011 – 2014 for dust fallout monitoring stations located on the mine's perimeter are indicated in Figure 19.

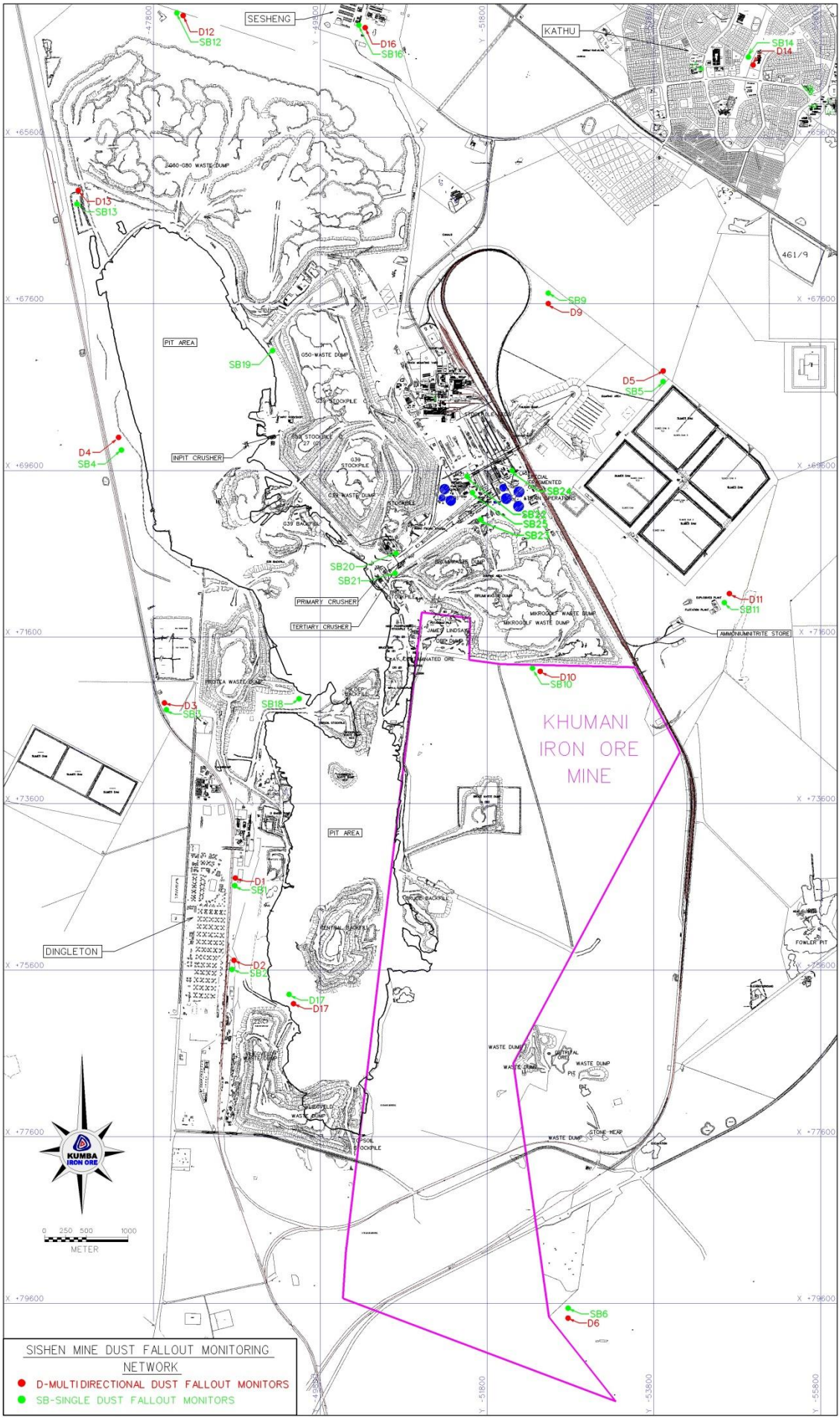


Figure 18: Dust monitoring network

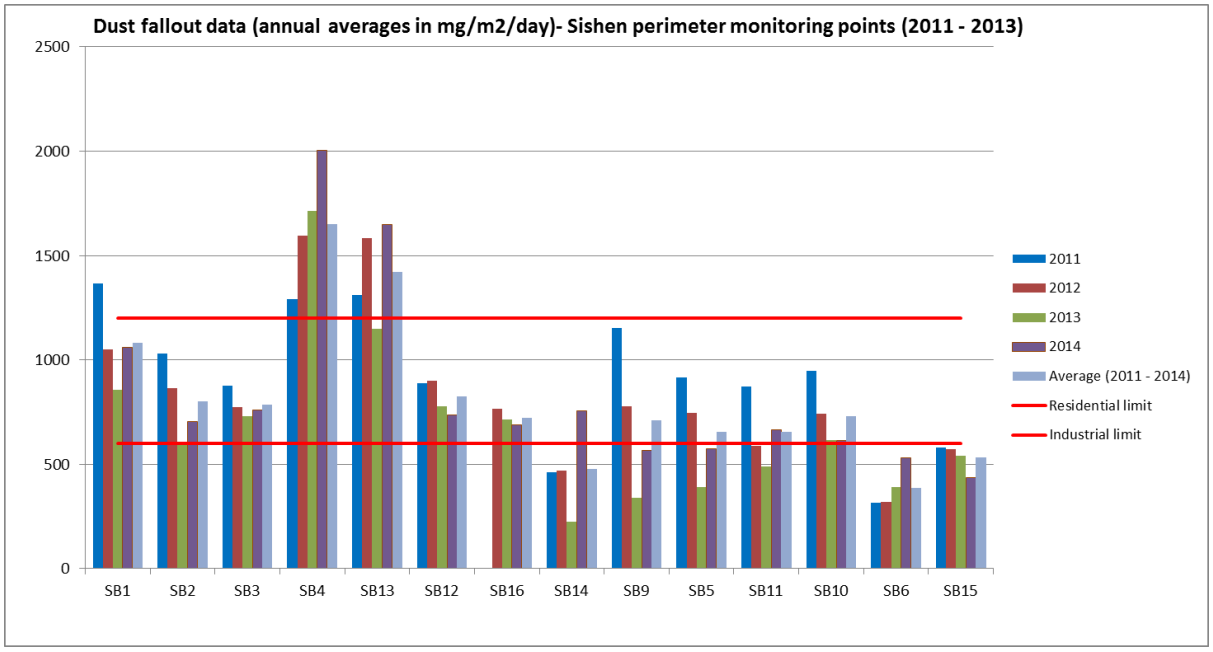


Figure 19: Annual average dust fallout results for 2011 - 2014

Dust fallout results are compared with the limits prescribed in GN 827 (7 December 2012). The limit value for residential and industrial areas are 600 mg/m2/day and 1200 mg/m^2/day respectively measured over a 30-day period.

- From Figure 19 it is evident that the background dust levels as measured at SB15 (a monitoring locality on a farm approximately 10km north of Sishen Mine are high (565 mg/m^2/day).
- Two of the monitoring localities have recorded annual average values of lower than 600 mg/m^2/day (SB6 and SB14).
- Nine of the monitoring localities have recorded annual average values of between 600 – 1200 mg/m^2/day.

Sishen Mine has a comprehensive dust management program in place to ensure dust levels are kept as low as possible. When considering the results provided, it is important to note that the background dust fallout results, as recorded at the Wincanton monitoring station, are generally also high.

Figure 20: Dingleton PM 10 Monitoring station

9.1.8 Visual

The visual environment of the area around Sishen Mine is characterised by open, undulating to flat sandy plains, with a series of hills orientated in a north-south axis, including the Kuruman and Langberg mountain ranges, forming a backdrop for the otherwise flat plains. Mining activities since 1950 have altered this landscape through the deposition of waste rock and slimes, and the construction of the mine and slimes dams.

The semi-arid open nature of the landscape renders it particularly sensitive to visual intrusion. Due to the relative flatness of the landscape, views in the area are being dominated by the mine dumps that can be seen from great distances.

Areas frequented by tourists are generally regarded as more sensitive than agricultural areas in terms of visual impacts. However, there are no established guest farms/guest houses on any of the private farms immediately adjacent to the mine (NEWLA 2011 and EndemicVision, 2011).

9.1.9 Archaeological

A site visit was conducted by Mr. Neels Kruger from Exigo on the 10th of March 2015. The report detailing findings is attached as Appendix C.2.

The landscape around the project area is primarily well known for the occurrence of Earlier and Middle Stone Age occurrences, especially the Kathu Archaeological Complex with sites such as Kathu Pan, Kathu Townlands and Bestwood around the town of Kathu. Three occurrences of interest were identified in the Lylyveld North Waste Rock Dump expansion and Lylyveld South haul road extension Project study areas:

- Two low density LSA and MSA lithic occurrences (Site EXIGO-LHE-SA01, Site EXIGO-LHE-SA02) (Figure 21 and Figure 22) were identified along the proposed Lylyveld South haul road extension

route. These occurrences are of low heritage significance due to the small numbers of formal and diagnostic tools, and general loss of context of the lithics. It is recommended that the area be carefully monitored by an informed ECO since previously undetected heritage remains might occur in subsurface calcrete deposits.

- An exposure of magnetite-bearing ironstone (Site EXIGO-LWE-FT01) (Figure 23) with scarring on the rock surfaces occurs along the eastern periphery of the proposed Lylyveld North Waste Rock Dump expansion area. Even though the possibility of the outcrops being utilised as stone source by Stone Age people was considered, it was established that the scarring was probably the result of mechanical weathering. The site is therefore of no heritage significance.

Figure 21: LSA scrapers (left) and a broken MSA blade from Site EXIGO-LHE-SA01

Figure 22: An MSA scraper embedded in a calcrete surface (left) and MSA cores (centre, right) from Site EXIGO-LHE-SA02

Figure 23: View of stone tool bearing decomposing calcrete exposures at Site EXIGO-LWE-FT01

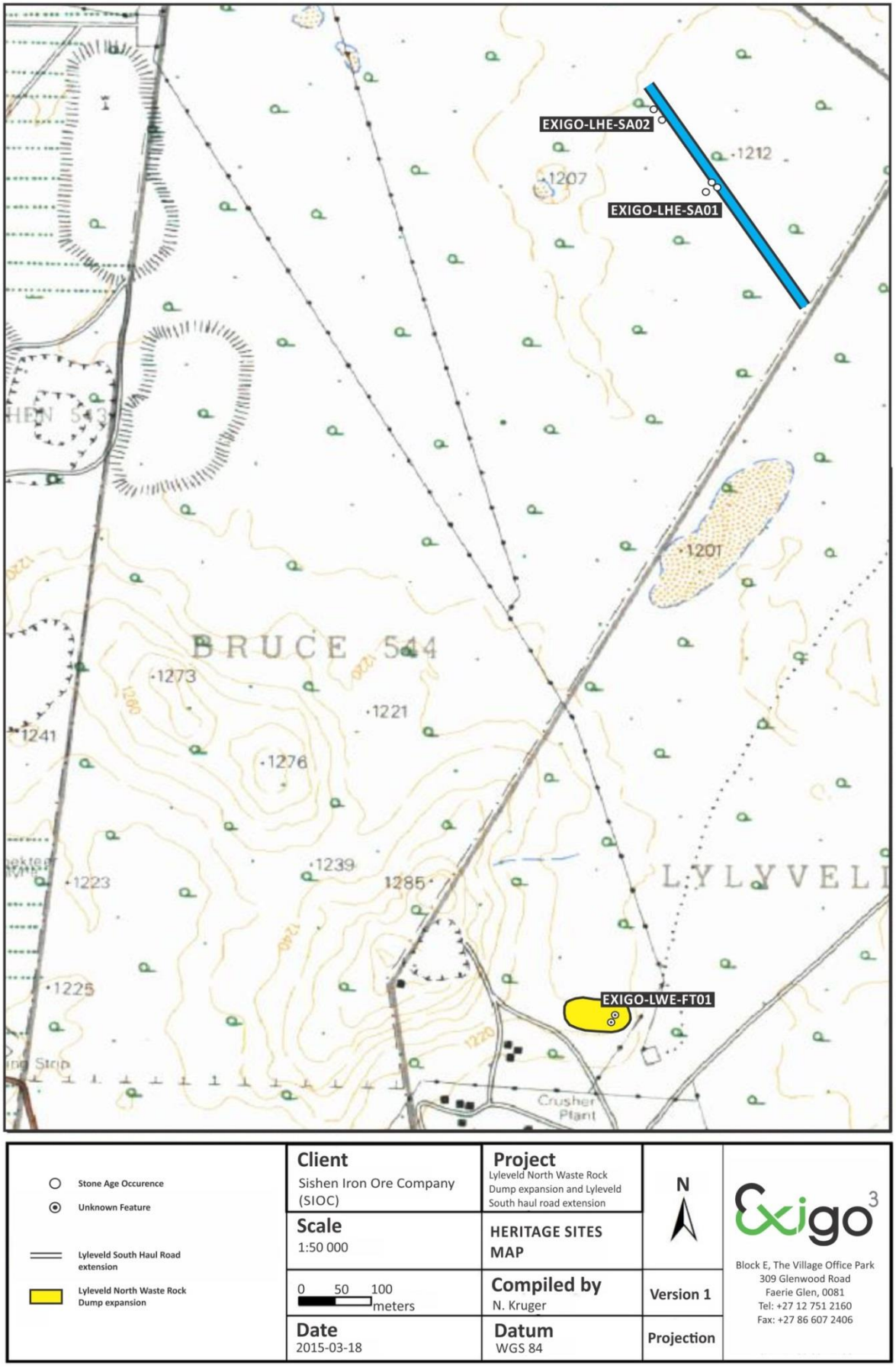


Figure 24: Topographic map indicating the locations of all heritage occurrences discussed in the text

9.1.10 Socio-Economic Structure

For Sishen mine to be able to reach their target of 360 000tons (must be 36 million tons – also see previous comments regarding wording of paragraph below) of ore the need to access the 30m eastern pit wall pushback of the Lylyveld North Open Pit. This will lead to additional waste being created in the range of 1,480,000m^3. This will lead to additional space being required which is not currently available. Therefore it was decided that an expansion of the current waste rock residue dump is required.

The Haul Road needs to be extended to cross the Bruce property mainly for safety purposes (same as earlier comments). Currently Sishen mine needs to share the Transnet service road. This leads to two major problems one being the safety of the Transnet workers that need to use the road and secondly the road is not wide enough to accommodate the Komatsu 795 trucks. It is also not preferred to have these large trucks on the same road as the Transnet personnel for safety reasons. With the construction of the extension over Bruce the Transnet service road can be give back to Transnet.

The road proposed also has less difficult and dangerous turns for the trucks.

The projects will lead to ongoing production resulting in the provision of jobs and generation of revenue to the region and the country as a whole.

Lylyveld North waste dump expansion and Haul road extension allows the mine to reach their targets required for ore abstraction and this will will lead to the continuation of the mine.

The Lylyveld projects have the potential to create an additional 33 jobs to the value of R5 940 000.000 per annum.

The following information is a combination of information obtained from the Social Study conducted as part of the Western Waste Rock Residue Deposits study (2012) and the 2011 census data. (please confirm this corresponds with earlier data)

Sishen mine is located in the Northern Cape Province in the John Taolo Gaetsewe District Municipality (JTGDM) and the Gamagara Local Municipality. The Northern Cape is South Africa's largest province, covering an area of 361 830 km2, representing 29.7% of South Africa's land mass. The province is divided into five administrative districts, namely Siyanda, Pixley Ka-Seme, Namaqua, Frances Baard and Kgalagadi, currently known as the John Taolo Gaetsewe District. The major towns in the province include Kimberley, De Aar, Kuruman, Upington, Calvinia and Springbok (John Taolo Gaetsewe District Municipality, 2012).

The JTGDM covers an area of 27 283 km2 and is made up of the Kgalagadi District Management Area as well as the Gamagara, Ga-Segonyana and Moshaweng Local Municipalities. Sishen Mine falls within the Gamagara Local Municipality. Towns within the Gamagara Local Municipality's area of jurisdiction include Kuruman, Kathu, Dibeng, Olifantshoek, Hotazel, Black Rock and Van Zylsrus (John Taolo Gaetsewe District Municipality, 2012).

The main industries in the municipal area include mining, agriculture and tourism. While Agricultural activities focus on cattle and goats, game farming and hunting are increasing in popularity (Aucamp, 2010).

The area is sparsely populated and characterised by vast open spaces with significant underground deposits of manganese and iron ore, the latter being the most prominent commodity in Gamagara's mainstay economic sector, which is mining (www.businesswomen.co.za).

The Gamagara Local Municipality is the geographically the smallest municipal area within the District Municipality and has the second smallest population size in the area. The primary land uses include mining (iron ore and manganese) and agriculture (cattle and goat farming). Water is supplied to the municipality by the Sishen Mine as a result of dewatering of the mining pits (Ptersa, 2011).

Kathu is one of the youngest towns in South Africa, founded in 1974 and owes its existence to the Sishen Mine. Kathu is often promoted as the 'Town under the Trees' because of its location in the Kathu 'Bos' (forest), which is famous for its Camel thorn trees.

Approximately 85% of the population of Kathu and Dingleton is associated with Sishen Mine and related industries. This includes employment in the various support services and trades. The other 15% of the population functions to cater for the needs of the affiliated community that include employment in shops, banks, garages, and other retail facilities. The municipality of Kathu similarly employs a notable percentage of the population.

The Sishen mine is one of the largest opencast iron mines in the world, and is the Northern Cape's largest employer (www.northerncapebusiness.co.za), and a major trainer of artisans in South Africa. Having identified skills shortages as one of the key hindrances to economic growth in the area, Sishen Mine boasts one of the few fully accredited institutions in South Africa that provides outstanding theoretical and practical training (www.kumba.co.za). The sheer scale of the mine means it has a significant impact socially, environmentally and economically. The mine recognises its role in the community and it works closely with local and district municipalities and other stakeholders to participate in the integrated development plan (IDP).

The SIOM employed 8 277 people of who 4 412 people were permanent employees and 3 865 were contract employees. Amongst the permanent employees, the greatest majority (about 54%) were semi-skilled and discretionary workers who in turn primarily comprised of plant and machine operators, whilst just slightly more than a third comprised of skilled technical workers and junior managers (Kumba Iron Ore Limited, 2011a). Through production-induced and consumption-induced effects, the mine further supported 31 233 Full Time Equivalent (FTE) employment positions in 2011. Therefore, the total contribution of the mine towards employment in the country was 39 510 FTE jobs. Unless the production costs of the mine change, these positive employment impacts can be expected throughout the rest of the mine's operational life. Given that the economy employed about 13.6 million people in 2011 (StatsSA, 2011), it can be suggested that the mine contributed to the provision of work for about 0.2% of employed people in the country (Urban-Econ, 2012).

The population in the Gamagara area has increased with almost a fifth since 2001 and as the Sishen mine is the largest employer in the area, it is likely that the increase in population is due to an increase in mining activities.

The province faces a number of societal challenges that predominantly emanate from the effects of poverty (Kgalagadi District Municipality, 2007). These challenges include reducing the backlog in services relating to basic needs such as water, sanitation and housing; access to health, education and social services; the prevalence of HIV and AIDS; creating of opportunities for employment; reducing crime and addressing the needs of vulnerable groups (Aucamp, 2012).

9.1.11 Economic Development

The following information is obtained from the Economic Study conducted as part of the Western Waste Rock Residue Deposits study (2012) by Urban Econ.

The importance of mining and mineral processing, in particular iron ore and manganese, driving economic development along with the agricultural, manufacturing, and tourism activities and is recognised by various provincial policies. The District Municipality's strategic documents further highlight the integral nature of the mining sector's development in ensuring sustainable livelihoods of the local communities and improving their standard of living. The SIOM itself is seen as a cornerstone of further expansion of the mining sector in the area. However, the strategic document call for the greater management of negative impacts associated with the mining activities, such as road congestion, road condition deterioration, and air pollution. A great emphasis is also made on the need to diversify the local economies to reduce the dependency on the mining activities' volatile nature and increase the sustainability of local communities, as well as on the need to perform more stringent environmental management and land use management. Overall, it can be concluded that the proposed project is in line with the local, provincial, and national developmental priorities; however, issues regarding negative impacts associated with mining activities will need to be taken into account (Urban-Econ, 2012).

Sishen Mine is one of the largest contributors to the economy of the Northern Cape. Sishen Mine's Social and Labour Plan was compiled with the Local Economic Development (LED) strategies and Integrated Development Plans (IDP) of the Gamagara Local Municipality and the Kgalagadi District Municipality as a guide. The Social and Labour Plan outlines Sishen Mine's commitment to contributing to the socio-economic development of its employees and the surrounding communities.

Unemployment remains one of the major challenges in some of these areas. The level of unemployment in communities around the mine differs due to skill and education levels. Kathu and Sesheng, both located closest to the mine, have the highest number of employed persons per household; Deben and Mapoteng have the highest number of households with at least one person unemployed compared with other towns.

9.1.12 Description of the current land uses.

Both the Lylyveld and Bruce sites are located within mining areas. Although still undisturbed footprint areas they have been demarcated for mining purposes

9.1.13 Description of specific environmental features and infrastructure on the site.

Only features mentioned above in section 9.1.2 and 9.1.9 are of importance the impact on the environmental features are however limited.

9.1.14 Environmental and current land use map.

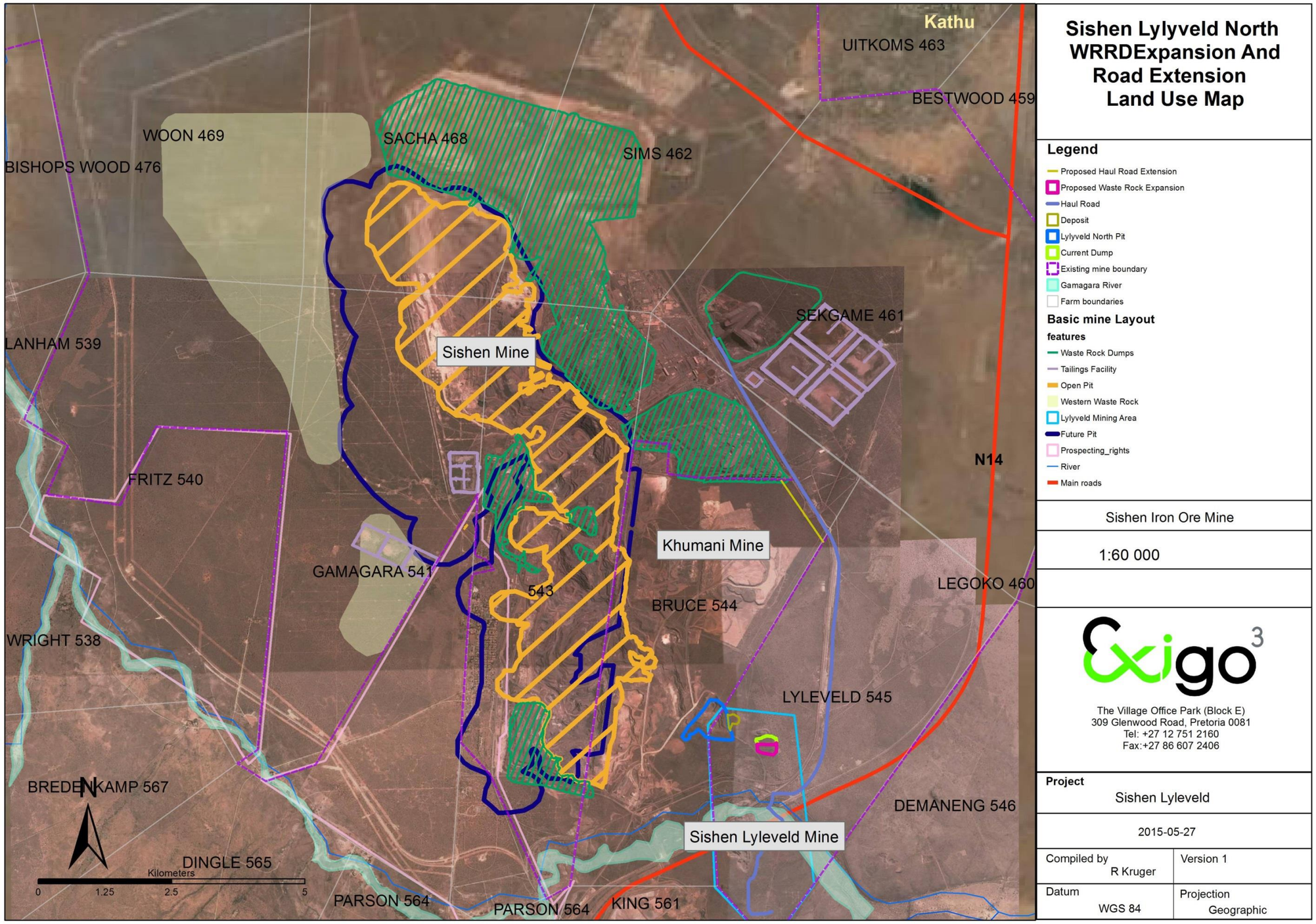


Figure 25: Aerial Landuse map of Sishen Mine area

10. IMPACTS IDENTIFIED

10.1 Methodology used in determining the significance of potential environmental impacts and risks;

An impact can be defined as any change in the physical-chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a project need.

The significance of the aspects/impacts of the process were rated by using a matrix derived from Plomp (2004) and adapted to some extent to fit this process. These matrixes use the consequence and the likelihood of the different aspects and associated impacts to determine the significance of the impacts.

The significances of the impacts were determined through a synthesis of the criteria below:

Probability. This describes the likelihood of the impact actually occurring.

Improbable:	The possibility of the impact occurring is very low, due to the circumstances, design or experience.
Probable:	There is a probability that the impact will occur to the extent that provision must be made therefore.
Highly Probable:	It is most likely that the impact will occur at some stage of the development.
Definite:	The impact will take place regardless of any prevention plans, and there can only be relied on mitigatory actions or contingency plans to contain the effect.

Duration. The lifetime of the impact

Short term:	The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases of the project.
Medium term:	The impact will last up to the end of the phases of the project, where after it will be negated.
Long term:	The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
Permanent:	Impact that will be non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.

Scale. The physical and spatial size of the impact

Local:	The impacted area extends only as far as the activity, e.g. footprint
Site:	The impact could affect the whole, or a measurable portion of the site.
Regional:	The impact could affect the area including the neighbouring residential areas.

Magnitude/ Severity. Does the impact destroy the environment, or alter its function.

Low: The impact alters the affected environment in such a way that natural processes are not affected.

Medium: The affected environment is altered, but functions and processes continue in a modified way.

High: Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

Significance. This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.

Negligible: The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.

Low: The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.

Moderate: The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.

High: The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation. The following weights were assigned to each attribute:

Aspect	Description	Weight
Probability	Improbable	1
	Probable	2
	Highly Probable	4
	Definite	5
Duration	Short term	1
	Medium term	3
	Long term	4
	Permanent	5
Scale	Local	1
	Site	2
	Regional	3
Magnitude/Severity	Low	2
	Medium	6
	High	8

Significance	Sum (Duration, Scale, Magnitude) x Probability	
	Negligible	<20
	Low	<40
	Moderate	<60
	High	>60

The significance of each activity will be rated without mitigation measures and with mitigation measures for both construction, operational and closure phases of the project.

Significance= Sum (Duration, Scale, Magnitude) x Probability

10.2 Identification of Key Issues

The key issues listed in the following section have been determined through the following avenues:

- Views of interested and affected parties (as part of previous EMPR's and EMPR Amendments);
- Relevant llegislation;
- Professional understanding of the project team, environmental assessment practitioners and
- The specialist assessments.

10.3 Impact analysis and proposed mitigation measures

The findings of the impact assessment have been consolidated in the sections below. The impacts have been classified as impacts on the biophysical environment and impacts on the socio-economic environment. The impacts are further classified in terms of the phase of the development in which they are likely to occur, namely the construction phase, the operational phase and the decommissioning phase (where applicable).

During their analysis, specialists were required to consider the impact significance before and after mitigation measures are implemented.

Even though some impacts are perceived to be of high severity, it must be highlighted that the probability of these impacts occurring might be low and therefore the significance of the impact is reduced.

10.4 The positive and negative impacts

(Provide a discussion in terms of advantages and disadvantages of the initial site layout compared to alternative layout options to accommodate concerns raised by affected parties)

On Alternatives please refer to section 7.

10.4.1 Ecological Impacts

10.4.1.1 Direct habitat destruction

The proposed development of the haul road and WRD will result in some loss of and damage to natural habitats if the vegetation is cleared. Rehabilitation of some areas would be possible but there is likely to be long-term damage in a small footprint area. Most habitat destruction will be caused during the construction phase, but some may also occur during the operational phase. The impact of the habitat destruction will be on the flora and fauna of the study area:

- The construction will lead to the loss of individual plants such as grasses, forbs, trees and shrubs that will be cleared on the footprint area;
- Loss of protected and endemic taxa: The anticipated loss of some of the woodland habitats that support protected tree species will result in the local displacement of these tree species;
- The construction activities can impact on surrounding vegetation by dust and altered surface run-off patterns;
- The disturbance of the area could lead to an increase in the growth of alien vegetation;

The following major impacts of the proposed development will potentially impact on the faunal habitats of the site:

- Habitat modification by construction activities will force animals out of the area and animal numbers will decrease. This impact could also take place because of hunting and snaring of animals in natural areas.

- The anticipated loss of the natural woodland (Habitat destruction and fragmentation) will result in the local displacement of endemic fauna species utilizing these specific habitats;

- The changes to the vegetation of the site might result in change to fauna species composition of habitats. The prediction would be that more generalist species will dominate the study area, compared to reference conditions before mining commenced in the area.

10.4.1.2 Habitat fragmentation

The construction of the development of the haul road and expansion of the dump will result in natural movement patterns being disrupted and, to a varying degree depending on how different species react to these barriers will result in the fragmentation of natural populations. The development will have a small impact in fragmenting the habitats. Such impacts would be short-term provided that proper rehabilitation methods are used.

10.4.1.3 Increased Soil erosion and sedimentation

The construction activities associated with the developments may result in widespread soil disturbance and is usually associated with accelerated soil erosion. Soil, sediments and associated contaminants may be

transported into water bodies associated within the larger area (pans, Gamagara River), resulting in the alteration of habitats for aquatic organisms, as well as changes in water quality. Soil erosion also promotes a variety of terrestrial ecological changes associated with disturbed areas, including the establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous fauna and flora.

10.4.1.4 Soil and water pollution

Construction work of the magnitude contemplated for the proposed development will carry a small, insignificant risk of soil and water pollution, with spillages from heavy mining equipmentposing a contamination riks If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface or ground water, leading to potential medium/long-term impacts on fauna and flora. During the operational phase heavy machinery and vehicles as well as sewage and domestic waste would be the main contributors to potential pollution problems. This impact would be significant if not mitigated, especially considering that the haul road will be utilized on a daily basis during the operational phase.

10.4.1.5 Air pollution

The environmental impacts of wind-borne dust, gases and particulates from the construction activities associated with the proposed development are primarily related to ecosystem damage. The proposed development will typically comprise the following sources and associated air quality pollutants:

- Land clearing operations, building and scraping;
- Stockpiling (particulate matter);
- Materials handling operations (truck loading & unloading, tipping, stockpiling);
- Vehicle entrainment on paved and unpaved roads;
- Windblown dust-fugitive emissions (stockpiles).

The impact of dust and pollutants from exhaust gasses on the ecosystem will be small and insignificant considering the mitigation measures applied by the Sishen Mine. Poor air quality results in deterioration of visibility and aesthetic landscape quality of the region, particularly in winter due to atmospheric inversions.

10.4.1.6 Spread and establishment of alien invasive species

This is probably one of the most significant potential impacts from a terrestrial invertebrate perspective, and also may have very significant knock-on effects that could impact of virtually every aspect of the surrounding ecosystem. The construction almost certainly carries by far the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. Continued movement of personnel and vehicles on and off the site, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project.

10.4.1.7 Negative effect of human activities and road mortalities

Large numbers of fauna are also killed daily on roads. They are either being crushed under the tyres of vehicles in the case of crawling species, or by colliding with the vehicle itself in the case of avifauna or flying invertebrates. The impact of the haul road on the local fauna population would be small considering the degraded and fragmented state of the fauna habitats surrounding the Sishen Mine.

10.4.2 Groundwater Impact

During construction the impact on groundwater resources are limited to:

- Oil, grease and diesel spillages possible causing pollution
- Flooding of the construction camps
- Storage of chemicals posing pollution risk and
- Pollution from sanitation facilities

In the Construction Phase, latrines are sealed units that are portable, which presents a potential impact from non-mitigated spillages. Basic measures can be taken to minimise or manage potential impacts. During the construction phase the impacts are mostly of negligible significance. Increased run-off and clearance of vegetation could lead to erosion gullies forming. This will have a negligible impact. The flooding of the construction camps will only take place in severe rainfall events. Construction vehicles could possibly lead to oil, grease and diesel spillages if not maintained properly.

The following impacts could occur during the operational phase:

- Contamination of groundwater from Waste Rock Dump (WRD) leachate
- Diesel contamination from refuelling stations

A geochemical leach study was recently conducted by Exigo (2014) in which the maximum leachable nitrate concentration in the Sishen mine residue material was shown to be 16.4 mg/l as NO_3. This is 33% of the SANS drinking water standard. In addition to the leach study, groundwater monitoring data was analysed and a geochemical model was developed for the waste rock dump material. The groundwater monitoring data analysis showed that none of the boreholes downstream of the existing waste rock dumps contained nitrate concentrations in excess of the SANS drinking water standards. The waste rock can therefore be classified as inert (Refer to Appendix C3).

10.4.3 Surface water

The following impacts on surface water are foreseen:

- Sedimentation of natural water resources – construction phase
- Contaminated stormwater runoff - operational phase

The proposed Lylyveld Mining operations and projects will be about approximately 1km (waste rock dump) and 5km (haul road) north of the Gamagara River, and it can consequently be expected that the mining will not have any influence on the river or drainages thereto.

During the operation phase rain water runoff from the side slope of the waste dumps will be classified as dirty water. Rain water falling on top of the waste dumps will gravitate to the middle of the dump from where it drains or evaporates. Similarly, clean water berms will be constructed to ensure the separation of clean and dirty water according to Government Notice 704 of the National Water Act, 1998 (Act No. 36 of 1998).

10.4.4 Topography

The waste dump expansion site is situated on an area classified as "Open Hills or Ridges" and the Haul road on an area classified "Level plains with some relief" according to the Environmental Potential Atlas of South Africa (ENPAT, 2000).

The current Lylyveld North waste rock dump is located 20m higher than the N14 road which is located 1.2km to the south of the dump. Therefore the dump might be visible to passers-by, however due to the main mining activities located to the North and North-West of the dump the dump extension could blend into the disturbed background.

The following activities may result in an impact on topography and the visual environment:

- Construction:
    - Construction earthworks: clearing of previously undisturbed sites
- Operations:
    - Deposition of waste rock materials in dumps adjacent to the existing dump and surrounding area

10.4.5 Air Quality

Dust generating activities associated with the proposed project include windblown dust from the Waste Rock Residue Deposits, waste rock dumps, material handling and vehicle entrainment from the haul trucks on the roads.

In the dispersion model undertaken for the whole of Sishen Mine it is evident that the main sources of emissions at Sishen are the unpaved roads. Haul roads account for ~60% and 50% of the total Suspended Particles (TSP) and PM10 emissions respectively. Wind erosion is the second highest emission source for both TSP and PM10 with crushing ranking third for both particle size categories.

The new haul road will be sprayed with dust-a-side and is therefore not foreseen to be a contributor to the dust emissions (Refer to Figure 5). The waste residue dump could however still be a pollution source. It should however be noted that the proposed waste residue dump in relation to the bigger mining area is of small significance with the new dump only excepting about 1% of the mines total waste tonnage[2].

[2] The whole Sishen mine generates in the region of 200 million tons of waste per annum while the Lylyveld North dump will generate approximately 1.5million tons of waste per annum.

The rating of the impact was however dived into two categories one being the impact of the project by itself and the other looking at the cumulative impact of the mine and the new project. For the cumulative impact the monitoring at the mine was taken into account.

The PM10 daily and annual SA standards (effective from Jan 2015) have been exceeded at the Sesheng upwind monitor for the 2014 year annual average. The significance ranking for the cumulative operational phase is therefore high due to the background limits exceeding. The NAAQSs have an allowable frequency of exceedance of the PM10 daily limits (120 µg/m³ for industrial and 75 µg/m³ for residential areas) of 4 days per calendar year. Continuous improvement projects are underway to reduce the cumulative impact of the mine.

10.4.6 Heritage Impact

The landscape around the project area is primarily well known for the occurrence of Earlier and Middle Stone Age occurrences, especially the Kathu Archaeological Complex with sites such as Kathu Pan, Kathu Townlands and Bestwood around the town of Kathu. Three occurrences of interest were identified in the Lylyveld North Waste Rock Dump expansion and Lylyveld South haul road extension Project study areas:

- Two low density LSA and MSA lithic occurrences (Site EXIGO-LHE-SA01, Site EXIGO-LHE-SA02) were identified along the proposed Lylyveld South haul road extension route. These occurrences are of low heritage significance due to the small numbers of formal and diagnostic tools, and general loss of context of the lithics. It is recommended that the area be carefully monitored by an informed ECO since previously undetected heritage remains might occur in subsurface calcrete deposits.
- An exposure of magnetite-bearing ironstone (Site EXIGO-LWE-FT01) with scarring on the rock surfaces occurs along the eastern periphery of the proposed Lylyveld North Waste Rock Dump expansion area. Even though the possibility of the outcrops being utilised as stone source by Stone Age people was considered, it was established that the scarring was probably the result of mechanical weathering. The site is therefore of no heritage significance.

10.4.7 Socio Economic impact (Positive)

The development of the Waste Rock Residue Deposits will result in cumulative positive socio-economic impacts due to the ongoing provision of jobs and the contribution to the economy at a local and district level. The economies of the Northern Cape Province and South Africa will also benefit due to the ongoing provision of raw material for the production of steel. The mine is the Northern Cape's largest employer (www.northerncapebusiness.co.za), and a major skill developer of artisans in South Africa. Having identified skills shortages as one of the key hindrances to economic growth in the area, Sishen boasts one of the few fully accredited institutions in South Africa that provides outstanding theoretical and practical training (www.kumba.co.za).

10.4.7 Safety impact (Positive)

The Haul Road needs to be extended to cross the Bruce property mainly for safety purposes. Currently Sishen mine needs to share the Transnet service road. Currently Sishen mine needs to share the Transnet service road. This leads to two major problems, one being the safety of the Transnet workers that need to use the road and secondly the road is not wide enough to accommodate the Komatsu 795 trucks. It is also not preferred to have these large trucks on the same road as the Transnet personnel for safety reasons. With the construction of the extension over Bruce, the Transnet service road do not have to be shared between HME and light vehicles.

This will lead to a high significant positive safety increase.

Table 11 below lists the impacts and also provides an indication of the phase of the project to which the potential impact relates.[3]

Table 11: List of impacts identified

No	Activity/Aspect	Impact	Phase
Ecological Impacts			
1	Clearing of vegetation for construction activities, construction of infrastructure, access roads etc. Habitat destruction	Habitat destruction	Construction
2	Clearing of vegetation for development footprints, construction of infrastructure, access roads etc.	Habitat fragmentation	Construction
3	Exposure of soils to rainfall and wind during construction	Soil erosion	Construction
4	Movement of vehicles on site during construction	Spillage of harmful substances	Construction
5	Continued movement of personnel and vehicles on and off the site during the construction phase, as well as occasional delivery of materials required for maintenance	Spread of alien invasive species	Construction
6	Construction of waste rock dump and haul road	Negative effect of human activities on flora	Construction
7	Exposure of soils to rainfall and wind during	Dust contamination	Construction

[3] Please note that the construction period for the road is very limited. The construction of the residue dump is limited to clearing while the operational phase refers to the waste rock building.

	construction		
Groundwater			
8	Contamination of groundwater from leaching of stockpiled rock and soil	Ground Water Pollution	Construction
9	Contamination of groundwater from fuel leaks from vehicles and storage	Ground Water Pollution	Construction
10	Contamination of groundwater from Waste Rock Dump (WRD) leachate	Ground Water Pollution	Operation
Surface water			
12	Contamination of surface water from stockpiled rock and soil	Surface water pollution	Construction/Operation
13	Contamination of surface water arising from run-off from waste dumps	Surface water pollution	Construction/Operation
Topography			
14	Altering the existing topography of the site	Deposition of waste and overburden materials in dumps	Construction/Operation
Air quality			
15	Pollution from Dust and PM10 at sensitive receptors - Project on it own	Air pollution	Construction
16	Pollution from Dust and PM10 at sensitive receptors - Project on it own	Air pollution	Operation
17	Pollution from PM10 at sensitive receptors - **Cumulative** impact	Air pollution	Construction
18	Pollution from PM10 at sensitive receptors - **Cumulative** impact	Air pollution	Operation
Heritage Impacts			
19	Destruction of site of Archaeological importance	Construction activities	Construction
Social Impacts			
20	Job creation or maintaining (Positive)	Economic Impact	Construction/Operation
Safety Impacts			
21	Safety of Transnet workers (Positive)	Safety impact	Operation

10.5 The possible mitigation measures that could be applied and the level of risk

Table 12: List of mitigation measures for impacts

No	Activity/Aspect	Impact	Phase	Proposed Mitigation/management measures
Ecological Impacts				
1	Clearing of vegetation for construction activities, construction of infrastructure, access roads etc. Habitat destruction	Habitat destruction	Construction	• The removal of the indigenous trees and shrubs should only occur on the footprint area of the proposed haul road and WRD footprint and not over the larger area. No trees may be trimmed or removed without the prior permission of the project manager or Environmental Control Officer (ECO). • Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area. • Monitoring should be implemented during the construction phase of the development to ensure that minimal impact is caused to the fauna of the area. • The ECO should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. The ECO should enforce any measures that he/she deem necessary. Regular environmental training should be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation. • Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist
2	Clearing of vegetation for	Habitat	Construction	• Use existing facilities (e.g., access roads, degraded areas) to the extent

	development footprints, construction of infrastructure, access roads etc.	fragmentation		possible to minimize the amount of new disturbance. • Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. All possible efforts must be made to ensure as little disturbance as possible to the sensitive habitats on site during construction; • Where necessary and feasible, the construction of landscaped culverts to a depth of 300 mm will allow the free movement for small mammals, reptiles and amphibians from one side of the haul routes to the other. These will need to be maintained throughout the operational phase and beyond; • Where necessary and feasible, berms, low walling or fencing could be constructed in order to guide animals towards these culverts to promote the use of the abovementioned passageways; • During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place. Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas
3	Exposure of soils to rainfall and wind during construction	Soil erosion	Construction	• Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices. Control dust on construction sites and access roads using water-sprayers. • Institute a storm water management plan including strategies such as: o minimising impervious area o increasing infiltration to soil by use of recharge areas • Have permanent erosion control plans that focus on the establishment of stable native vegetation communities. • Ensure the amount of bare soil exposed is minimized by staging earthworks in phases and leaving as much ground cover intact as possible during construction. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from construction activities. • Any topsoil dumps should not be compacted, nor should any object be placed or deposited upon it, as far as possible
4	Movement of vehicles on site during construction	Spillage of harmful substances	Construction	• Water falling on areas polluted with oil/diesel or other hazardous substances must be contained. Any excess or waste material or chemicals should be removed from the site and discarded in an environmental friendly way. The ECO should enforce this rule

				rigorously. • Chemicals to be stored on an impervious surface protected from rainfall and storm water run-off. • Polluted soils must be removed to the bioremediation facility or treated in situ where it is difficult to remove. If it is not possible to contain the spill, the site needs to be closed off and a full site assessment needs to be undertaken (relevant specialist advice to be obtained prior to the activities on-site being ceased). • Ensure that refuelling stations on site are constructed so as to prevent spillage of fuel or oil onto the soil, and put in place measures to ensure that any accidental spillages can be contained and cleaned up promptly. • Sewage should either be treated in a suitable plant or removed from the site for treatment elsewhere. • Spill kits should be on-hand to deal with spills immediately; • Spillages or leakages must be treated according to an applicable procedure as determined by a plan of action for the specific type of disturbance; • All construction vehicles should be inspected for oil and fuel leaks regularly and frequently. Vehicle maintenance will not be done on site except in emergency situations in which case mobile drip trays will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier
5	Continued movement of personnel and vehicles on and off the site during the construction phase, as well as occasional delivery of materials required for maintenance	Spread of alien invasive species	Construction	• Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish. • Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. • Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented.
6	Construction of waste rock dump and haul road	Negative effect of human activities on flora	Construction	• Adequate rubbish bins and sanitation facilities should be provided. • The ECO should regularly inspect the site, including storage facilities and compounds and eradicate any invasive or exotic plants and animals. • Maintain proper firebreaks around entire development footprint. • Educate construction workers regarding risks and correct disposal of cigarettes. • More fauna are normally killed the faster vehicles travel. A speed limit should be enforced (preferably 60 km/hour).

				• Travelling at night should be avoided or limited as much as possible.
7	Exposure of soils to rainfall and wind during construction	Dust contamination	Construction	• Dust suppression must be undertaken in conjunction with a dust monitoring programme comprising of dust buckets, high volume active air samplers or continuous particle monitors or even personal exposure samplers at generation sites, around the mine and in adjacent areas. An air quality management programme must be implemented to ensure compliance with the National Environmental Management: Air Quality Act 39 of 2004. These should be monitored regularly to ascertain the dust load and emission rates and particle size distribution; • Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation. A speed limit (preferably 60 km/hour) should be enforced on dirt roads
Groundwater				
8	Contamination of groundwater from leaching of stockpiled rock and soil	Ground Water Pollution	Construction	• Latrines should be kept away from sensitive areas with direct access to groundwater, such as boreholes and drainage lines. Portable latrines should be sealed units that can be cleaned by truck and the waste must be taken to a suitable sewage facility for treatment. They should be well maintained and regularly cleaned and sewage should not be allowed to directly access the groundwater or surface water systems • Any deposited soil and rock should have storm water management measures implemented • Groundwater monitoring must take place at the groundwater monitoring localities specified by the DWA WUL • Groundwater monitoring programme to be reviewed annually and changes made if required to ensure optimised monitoring program • Ongoing pollution source identification and management should take place • The overburden and waste dumps should be designed for concurrent rehabilitation and runoff should be contained in toe paddocks and storm water containment dams according to GN704 and the DWA Best Practices (DWA, 2006a)
9	Contamination of groundwater from fuel leaks from vehicles and storage	Ground Water Pollution	Construction	
10	Contamination of groundwater from Waste Rock Dump (WRD) leachate	Ground Water Pollution	Operation	
Surface water				
12	Contamination of surface water from stockpiled rock and soil	Surface water pollution	Construction/Operation	• Stormwater management systems should be implemented and maintained according to GN 704 principles. • Dirty areas will be isolated and pollution managed and reduced at the

13	Contamination of surface water arising from run-off from waste dumps	Surface water pollution	Construction/Operation	source. The 1:50 year flood event will be catered for. • Hazardous substances must be managed in accordance with Sishen Mine procedures • No bins containing organic solvents such as paint and thinners shall be cleaned on the mine • Chemicals and oil storage facilities must be bunded • Construction vehicles and machines must be maintained properly and regularly to ensure that hydrocarbon spillages are kept to a minimum • Hydrocarbon spills shall be contained through the use of soil, Safsorb or any other suitable dry material. • Spill kits must be easily accessible at operations where there is a risk for hydrocarbon spillage • Provide bins for construction workers at appropriate positions for disposal of domestic waste • Conduct an awareness and training programme to reinforce sound environmental principles with regard to waste management and water pollution • Environmental related incidents must be reported to the SHEQ department
Topography				
14	Altering the existing topography of the site	Deposition of waste and overburden materials in dumps	Construction/Operation	• All waste rock dumps will be managed according to the SIOM Code of practice (COP) on mine residue deposits. • In order to minimise the impact on the topography, the following measures will be implemented: o Where waste rock dumps occur which cannot economically be returned to the pit, these will be shaped to ensure a stable and self-sustainable slope (24°). o Ongoing projects to optimally utilise the resource will be employed to minimise the placing of waste material on surface. o Concurrent rehabilitation will take place as far as possible in order to mitigate the topographical impact. o On-going rehabilitation and vegetation of the impacted areas must be done as far as possible . o Locate storm water diversion trenches to have the minimum impact on topography.
Air quality				
15	Pollution from Dust and PM10 at sensitive receptors - Project on it own	Air pollution	Construction	In order to reduce vehicle entrained dust the mitigation measures include: o Unpaved roads should be properly maintained by grading and shaping

16	Pollution from Dust and PM10 at sensitive receptors - Project on it own	Air pollution	Operation	to prevent dust generation caused by excessive road surface wear. o For haul roads water and where practically possible water sprays in combination with chemicals will be applied. o Wet or chemical suppression of unpaved areas will be applied continuously as part of the continuous road maintenance and dust suppression standards o Inspect road integrity and repair frequently. • Measures to reduce dust pollution from deposits include: o A chemical (but bio-degradable and non-toxic) dust suppressant can also be used if needed. • Compliance monitors, for measuring PM levels should be implemented at the main residential areas of Kathu, Sesheng and Dingleton o Regular monitoring of PM10 and PM2.5and dust fallout around the mine, should take place to test for compliance to regulations. During transportation of waste rock the following mitigation can be applied: • Apply water, or a mixture of water and chemicals for dust suppression on mine haul roads, • Chemical treatment of permanent roads. • Proper maintenance of transport vehicles o Speed limit on on-site roads o Optimizing haulage distances to be as short as possible o It is desirable to plan the waste rock dump rehabilitation to occur as early as possible in the life of the mine. Establishing the final faces of waste rock dumps early and re-vegetating these surfaces will significantly reduce wind erosion.
17	Pollution from PM10 at sensitive receptors - **Cumulative** impact	Air pollution	Construction	
18	Pollution from PM10 at sensitive receptors - **Cumulative** impact	Air pollution	Operation	
Heritage Impacts				
19	Destruction of site of Archaeological importance	Construction activities	Construction	A careful watching brief monitoring process is recommended whereby an informed ECO inspect the construction sites on regular basis in order to monitor possible impact on heritage resources. Should any subsurface paleontological, archaeological or historical material or heritage resources be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately
Social Impacts				
20	Job creation or maintaining (Positive)	Economic Impact	Construction/Operation	• The mine should seek to employ people from the local communities to improve the unemployment situation in the area and preference should ideally be given to town and communities with the greatest

				unemployment levels such as Deben, Olifantshoek, Dingleton, and Sesheng • The mine should continue increasing its procurement practices from local and BEE enterprises to increase the positive impact in the local economy
Safety Impacts				
21	Safety of Transnet workers (Positive)	Safety impact	Operation	The Transnet service road must be given back to Transnet and the road not used for mining activities

10.6 Motivation where no alternative sites were considered

N/A – Refer to section 7

10.7 Statement motivating the alternative development location within the overall site.

The areas included in the infrastructure were identified through methods listed in Section 7.

10.8 Description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (In respect of the final site layout plan) through the life of the activity.

Refer to section 10.4 and 10.5

10.9 Assessment of each identified potentially significant impact and risk

(This section of the report must consider all the known typical impacts of each of the activities (including those that could or should have been identified by knowledgeable persons) and not only those that were raised by registered interested and affected parties).

The supporting impact assessment attached as Appendix D

Table 13: Impact and risk identification

No	Activity/Aspect	Impact	Phase	Significance (WOM)		Proposed Mitigation/management measures	Significance (WM)	
Ecological Impacts								
1	Clearing of vegetation for construction activities, construction of infrastructure, access roads etc. Habitat destruction	Habitat destruction	Construction	60	Moderate	• The removal of the indigenous trees and shrubs should only occur on the footprint area of the proposed haul road and WRD footprint and not over the larger area. No trees may be trimmed or removed without the prior permission of the project manager or Environmental Control Officer (ECO). • Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area. • Monitoring should be implemented during the construction phase of the development to ensure that minimal impact is caused to the fauna of the area. • The ECO should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. The ECO should enforce any measures that he/she deem necessary. Regular environmental training should be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation. • Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for	35	Low

						the raptors occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist		
2	Clearing of vegetation for development footprints, construction of infrastructure, access roads etc.	Habitat fragmentation	Construction	60	Moderate	• Use existing facilities (e.g., access roads, degraded areas) to the extent possible to minimize the amount of new disturbance. • Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. All possible efforts must be made to ensure as little disturbance as possible to the sensitive habitats on site during construction; • Where necessary and feasible, the construction of landscaped culverts to a depth of 300 mm will allow the free movement for small mammals, reptiles and amphibians from one side of the haul routes to the other. These will need to be maintained throughout the operational phase and beyond; • Where necessary and feasible, berms, low walling or fencing could be constructed in order to guide animals towards these culverts to promote the use of the abovementioned passageways; • During construction, sensitive habitats must be avoided by construction vehicles and equipment,	35	Low

						wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place. Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas		
3	Exposure of soils to rainfall and wind during construction	Soil erosion	Construction	48	Moderate	• Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices. Control dust on construction sites and access roads using water-sprayers. • Institute a storm water management plan including strategies such as: o minimising impervious area o increasing infiltration to soil by use of recharge areas • Have permanent erosion control plans that focus on the establishment of stable native vegetation communities. • Ensure the amount of bare soil exposed is minimized by staging earthworks in phases and leaving as much ground cover intact as possible during construction. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from construction activities. • Any topsoil dumps should not be compacted, nor should any object be placed or deposited upon it, as far as possible	28	Low
4	Movement of vehicles on site during construction	Spillage of harmful substances	Construction	48	Moderate	• Water falling on areas polluted with oil/diesel or other hazardous substances must be contained. Any excess or waste material or chemicals should be removed from the site and discarded in an environmental friendly way. The ECO should enforce this rule rigorously. • Chemicals to be stored on an impervious	24	Low

						surface protected from rainfall and storm water run-off. • Polluted soils must be removed to the bioremediation facility or treated in situ where it is difficult to remove. If it is not possible to contain the spill, the site needs to be closed off and a full site assessment needs to be undertaken (relevant specialist advice to be obtained prior to the activities on-site being ceased). • Ensure that refuelling stations on site are constructed so as to prevent spillage of fuel or oil onto the soil, and put in place measures to ensure that any accidental spillages can be contained and cleaned up promptly. • Sewage should either be treated in a suitable plant or removed from the site for treatment elsewhere. • Spill kits should be on-hand to deal with spills immediately; • Spillages or leakages must be treated according to an applicable procedure as determined by a plan of action for the specific type of disturbance; • All construction vehicles should be inspected for oil and fuel leaks regularly and frequently. Vehicle maintenance will not be done on site except in emergency situations in which case mobile drip trays will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier		
5	Continued movement of personnel and vehicles on and off the site during the construction phase, as well as occasional delivery of materials required for maintenance	Spread of alien invasive species	Construction	48	Moderate	• Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish. • Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds.	24	Low

						• Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented.		
6	Construction of waste rock dump and haul road	Negative effect of human activities on flora	Construction	44	Moderate	• Adequate rubbish bins and sanitation facilities should be provided. • The ECO should regularly inspect the site, including storage facilities and compounds and eradicate any invasive or exotic plants and animals. • Maintain proper firebreaks around entire development footprint. • Educate construction workers regarding risks and correct disposal of cigarettes. • More fauna are normally killed the faster vehicles travel. A speed limit should be enforced (preferably 60 km/hour). • Travelling at night should be avoided or limited as much as possible.	28	Low
7	Exposure of soils to rainfall and wind during construction	Dust contamination	Construction	60	Moderate	• Dust suppression must be undertaken in conjunction with a dust monitoring programme comprising of dust buckets, high volume active air samplers or continuous particle monitors or even personal exposure samplers at generation sites, around the mine and in adjacent areas. An air quality management programme must be implemented to ensure compliance with the National Environmental Management: Air Quality Act 39 of 2004. These should be monitored regularly to ascertain the dust load and emission rates and particle size distribution; • Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation.	28	Low

						A speed limit (preferably 60 km/hour) should be enforced on dirt roads		
Groundwater								
8	Contamination of groundwater from leaching of stockpiled rock and soil	Ground Water Pollution	Construction	22	Low	• Latrines should be kept away from sensitive areas with direct access to groundwater, such as boreholes and drainage lines. Portable latrines should be sealed units that can be cleaned by truck and the waste must be taken to a suitable sewage facility for treatment. They should be well maintained and regularly cleaned and sewage should not be allowed to directly access the groundwater or surface water systems • Any deposited soil and rock should have storm water management measures implemented • Groundwater monitoring must take place at the groundwater monitoring localities specified by the DWA WUL • Groundwater monitoring programme to be reviewed annually and changes made if required to ensure optimised monitoring program • Ongoing pollution source identification and management should take place • The overburden and waste dumps should be designed for concurrent rehabilitation and runoff should be contained in toe paddocks and storm water containment dams according to GN704 and the DWA Best Practices (DWA, 2006a)	7	Negligible
9	Contamination of groundwater from fuel leaks from vehicles and storage	Ground Water Pollution	Construction	18	Negligible		5	Negligible
10	Contamination of groundwater from Waste Rock Dump (WRD) leachate	Ground Water Pollution	Operation	24	Low		16	Negligible
Surface water								
12	Contamination of surface water from stockpiled rock and soil	Surface water pollution	Construction/Operation	26	Low	• Stormwater management systems should be implemented and maintained according to GN 704 principles. • Dirty areas will be isolated and pollution managed and reduced at the source. The 1:50 year flood event will be catered for. • Hazardous substances must be managed in accordance with Sishen Mine procedures • No bins containing organic solvents such as paint and thinners shall be cleaned on the mine • Chemicals and oil storage facilities must be	9	Negligible
13	Contamination of surface water arising from run-off from waste dumps	Surface water pollution	Construction/Operation	26	Low		9	Negligible

						bunded • Construction vehicles and machines must be maintained properly and regularly to ensure that hydrocarbon spillages are kept to a minimum • Hydrocarbon spills shall be contained through the use of soil, Safsorb or any other suitable dry material. • Spill kits must be easily accessible at operations where there is a risk for hydrocarbon spillage • Provide bins for construction workers at appropriate positions for disposal of domestic waste • Conduct an awareness and training programme to reinforce sound environmental principles with regard to waste management and water pollution • Environmental related incidents must be reported to the SHEQ department		
Topography								
14	Altering the existing topography of the site	Deposition of waste and overburden materials in dumps	Construction/Operation	60	Moderate	• All waste rock dumps will be managed according to the SIOM Code of practice (COP) on mine residue deposits. • In order to minimise the impact on the topography, the following measures will be implemented: o Where waste rock dumps occur which cannot economically be returned to the pit, these will be shaped to ensure a stable and self-sustainable slope (24°). o Ongoing projects to optimally utilise the resource will be employed to minimise the placing of waste material on surface. o Concurrent rehabilitation will take place as far as possible in order to mitigate the topographical impact. o On-going rehabilitation and vegetation of the impacted areas must be done as far as possible . o Locate storm water diversion trenches to	40	Low

						have the minimum impact on topography.		
Air quality								
15	Pollution from Dust and PM10 at sensitive receptors - Project on it own	Air pollution	Construction	50	Moderate	In order to reduce vehicle entrained dust the mitigation measures include: o Unpaved roads should be properly maintained by grading and shaping to prevent dust generation caused by excessive road surface wear. o For haul roads water and where practically possible water sprays in combination with chemicals will be applied. o Wet or chemical suppression of unpaved areas will be applied continuously as part of the continuous road maintenance and dust suppression standards o Inspect road integrity and repair frequently. • Measures to reduce dust pollution from deposits include: o A chemical (but bio-degradable and non-toxic) dust suppressant can also be used if needed. • Compliance monitors, for measuring PM levels should be implemented at the main residential areas of Kathu, Sesheng and Dingleton o Regular monitoring of PM10 and PM2.5and dust fallout around the mine, should take place to test for compliance to regulations. During transportation of waste rock the following mitigation can be applied: • Apply water, or a mixture of water and chemicals for dust suppression on mine haul roads, •Chemical treatment of permanent roads. • Proper maintenance of transport vehicles o Speed limit on on-site roads o Optimizing haulage distances to be as short as possible o It is desirable to plan the waste rock dump rehabilitation to occur as early as possible in the life of the mine. Establishing the final	24	Low
16	Pollution from Dust and PM10 at sensitive receptors - Project on it own	Air pollution	Operation	60	Moderate		32	Low
17	Pollution from PM10 at sensitive receptors - **Cumulative** impact	Air pollution	Construction	50	Moderate		30	Low
18	Pollution from PM10 at sensitive receptors - **Cumulative** impact	Air pollution	Operation	75	High		65	High

						faces of waste rock dumps early and re-vegetating these surfaces will significantly reduce wind erosion.		
Heritage Impacts								
19	Destruction of site of Archaeological importance	Construction activities	Construction	70	High	A careful watching brief monitoring process is recommended whereby an informed ECO inspect the construction sites on regular basis in order to monitor possible impact on heritage resources. Should any subsurface paleontological, archaeological or historical material or heritage resources be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately	32	Low
Social Impacts								
20	Job creation or maintaining (Positive)	Economic Impact	Construction/Operation	26	Low	• The mine should seek to employ people from the local communities to improve the unemployment situation in the area and preference should ideally be given to town and communities with the greatest unemployment levels such as Deben, Olifantshoek, Dingleton, and Sesheng • The mine should continue increasing its procurement practices from local and BEE enterprises to increase the positive impact in the local economy	28	Low
Safety Impacts								
21	Safety of Transnet workers (Positive)	Safety impact	Operation	36	Low	The Transnet service road must be given back to Transnet and the road not used for mining activities	75	High

10.10 Summary of specialist reports

(This summary must be completed if any specialist reports informed the impact assessment and final site layout process and must be in the following tabular form):-

Table 14: Specialist summary

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Ecological Study, 2015	• The removal of the indigenous trees and shrubs should only occur on the footprint area of the proposed haul road and WRD footprint and not over the larger area. No trees may be trimmed or removed without the prior permission of the project manager or Environmental Control Officer (ECO). • Protected trees may only be removed once a permit is obtained for the removal thereof Please refer to full list in Section 10.5 and Appendix D	x	Section 10.5 and Appendix C
Archaeological study, 2015	• A careful watching brief monitoring process is recommended whereby an informed ECO inspect the construction sites on regular basis in order to monitor possible impact on heritage resources. Should any subsurface paleontological, archaeological or historical material or heritage resources be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately	x	Section 10.5 and Appendix C
Waste classification, 2014	• The Lylyveld waste rock material can be	x	Section 10.5 and Appendix C

	classified as inert, as it is unlikely that the material will leach contaminants into the groundwater system. • The current groundwater monitoring protocol should be continued but optimised in terms of sampling frequencies and parameters as there are a number of parameters that are consistently either low or below detection limits.		

Attach copies of Specialist Reports as appendix C

10.11 Environmental impact statement

10.11.1 Summary of the key findings of the environmental impact assessment;

All impacts can be mitigated to Moderate, Low or Negligible except for the cumulative operational air quality impact. However there is a cumulative effort from the mine to reduce the baseline.

Impacts of high significance **prior to mitigation** include:

- Pollution from PM10 at sensitive receptors - Cumulative impact – Operational phase
- Destruction of site of Archaeological importance

The conclusion of this EIA is:

- Ecological impact
    - All ecological impacts will be reduced to low after mitigation measures
- Groundwater
    - Groundwater impacts will be negligible after mitigation measures
- Surface water
    - Surface water impacts will be negligible after mitigation measures
- Air quality
    - The projects impact on air quality will be reduced to low after mitigation
    - The cumulative impact during operations of the project and the mine is still rated as high due to past exceedances. There are however various efforts being taken by the mine to reduce the cumulative impact. This could in future reduce the impact should the measures be effective. On-going monitoring is conducted to track progress
- Archaeological impact
    - The impact on archaeological features will be reduced to low should the mitigation measures be implemented in the form of a watching brief
- Social impact (Positive impact)
    - The impact on the social environment will stay low but would be of a positive nature
- Safety
    - The increase in safety due to the Haul road will lead to a high positive significance

Based on the assessment that was undertaken for the development, it is therefore concluded that the project would not result in significant environmental impacts and could therefore continue from an environmental point of view.

10.11.2 Final Site Map

Please refer to Figure 3 and Figure 7

10.11.3 Summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;

Please refer to Section 10.4

10.12 Proposed Impact Management Objectives and the Impact Management Outcomes for Inclusion in the EMPR;

Please refer to Table 16. Also note the following objectives for the project:

- Not to harm ecologically sensitive areas
- Not to pollute the groundwater resource
- Not to pollute the surface water resource
- To manage the Residue dump according to the SIOC Code of Practice
- To reduce the cumulative air quality of the mine by staying within the standards prescribed
- Not impact on site of Archaeological importance
- To enhance the socio-economic status of the surrounding area
- To provide a safe environment for workers to work in

10.13 Aspects for inclusion as conditions of Authorisation

Any aspects which must be made conditions of the Environmental Authorisation

All mitigation as listed in Section 10.5 must be adhered to.

10.14 Description of any assumptions, uncertainties and gaps in knowledge

(Which relate to the assessment and mitigation measures proposed)

There is an inherent level of uncertainty in impact assessment, as impact assessment essentially aims to determine what would happen in the future, and is thus associated with unforeseen and unforeseeable events. This uncertainty cannot be reduced by doing more research and has to be addressed by acknowledging the assumptions, uncertainties and gaps in knowledge associated with an impact assessment study (Thissen & Agustinata, 2008).

The conclusions and recommendations made in this impact assessment have to be routinely verified through monitoring exercises during the construction and operational phases of the proposed project, as measuring the actual impacts of a development as they occur is the only undisputable way of showing which impacts are of an acceptable significance and which impacts may require additional or adapted management measures in order to reduce their physical, measured impact.

Thus while this report was compiled with due regard to public consultation, authority consultation, specialist input and in accordance with the relevant legislation, it cannot be seen as a “promise” of what is going to happen, but rather should be seen as a scientific prediction of the most likely significant effects that could be brought about by the proposed project based on current knowledge.

The detailed specialist studies referred to the adequacy of their predictions. Where an uncertainty existed the precautionary principle was applied and the impact rated with a higher significance.

10.15 Reasoned opinion as to whether the proposed activity should or should not be authorised

10.15.1 Reasons why the activity should be authorized or not.

The activity should be authorised due to the fact that no un-mitigatable impacts or fatal flaws are foreseen for the projects.

10.15.2 Conditions that must be included in the authorisation

Refer to section 10.13

10.16 Period for which the Environmental Authorisation is required.

The current Life of Mine (LoM) is up until 2039.

10.17 Undertaking

Confirm that the undertaking required to meet the requirements of this section is provided at the end of the EMPr and is applicable to both the Basic assessment report and the Environmental Management Programme report.

The undertaking is applicable to both the Basic assessment report and the Environmental Management Programme report.

11. **FINANCIAL PROVISION**

State the amount that is required to both manage and rehabilitate the environment in respect of rehabilitation.

The amount need for rehabilitation according to the DMR rates is R8,308,308.96 (incl. Vat) (refer to Table 15). This includes the road and the expansion of the dump.

The financial provision was determined using the master rates from 2013 and escalating the amount by 5.7% per year up to 2015.

Table 15: Calculation of the Quantum

CALCULATION OF THE QUANTUM

Mine: Sishen Lyleveld Waste rock dump expansion and Haul road extension — **Location:**

Evaluators: R Kruger — **Date:** 12/05/2015

Risk Class	C
Area Sensitivity	MEDIUM

No.	Description	Unit	A	B	C	D	E=A*B*C*D
			Quantity	Master rate 2015	Multiplication factor	Weighting factor 1	Amount (rands)
1	Dismantling of **processing plant and related structures** (including overland conveyors and powerlines)	m3	0.00	12.25	1.00	1.00	0.00
2(A)	Demolition of **steel buildings and structures**	m2	0.00	170.58	1.00	1.00	0.00
2(B)	Demolition of **reinforced concrete buildings and structures**	m2	0.00	251.38	1.00	1.00	0.00
3	Rehabilitation of **access roads**	m2	45000.00	30.52	1.00	1.00	1229400.00
4(A)	Demolition and rehabilitation of **electrified railway lines**	m	0.00	296.27	1.00	1.00	0.00
4(B)	Demolition and rehabilitation of **non-electrified railway lines**	m	0.00	161.61	1.00	1.00	0.00
5	Demolition of **housing and/or administration facilities**	m2	0.00	341.16	1.00	1.00	0.00
6	**Opencast rehabilitation** including final voids and ramps	ha	0.00	173635.56	1.00	1.00	0.00
7	Sealing of **shafts, adits and inclines (boreholes)**	m3	0.00	91.58	1.00	1.00	0.00
8(A)	Rehabilitation of **overburden and spoils**	ha	0.00	119228.55	1.00	1.00	0.00
8(B)	Rehabilitation of processing waste **deposits and evaporation ponds (basic salt-producing waste)**	ha	0.00	148497.01	1.00	1.00	0.00
8(C)	Rehabilitation of processing waste **deposits and evaporation ponds (acidic, metal-rich waste)**	ha	11.00	431305.69	1.00	1.00	4744362.55
9	Rehabilitation of **subsided areas**	ha	0.00	99835.95	1.00	1.00	0.00
10	**General surface rehabilitation**	ha	0.00	94449.12	1.00	1.00	0.00
11	River diversions	ha	0.00	94449.12	1.00	1.00	0.00
12	Fencing	m	0.00	107.74	1.00	1.00	0.00
13	**Water management**	ha	0.00	35912.22	1.00	1.00	0.00
14	2 to 3 years of **maintenance and aftercare**	ha	0.00	1256.93	1.00	1.00	0.00
15A	Specialist study	Sum	0.00	0.00	1.00	1.00	
15B	Specialist studies (soil remediation)	ha	0.00	0.00	1.00	1.00	0.00
					SubTotal 1		**5 973 763**
			(Sum of items 1 to 15 above)				
	Preliminary and General	6.0%	if Subtotal 1 > 100 000 00		Weighting factor 2		
		12.0%	if Subtotal 1 < 100 000 000			1.00	716 852
	Contingency		10.0%				597 376
					SubTotal 2		**7 287 990**
			(Subtotal 1 plus sum of management and contingency)				
					Add Vat (14%)		1 020 319
					GRAND TOTAL		**8 308 308.96**
					(Subtotal 2 plus VAT)		

11.1 Explain how the aforesaid amount was derived

The financial provision for the waste rock dump and Haul road was determined by using the DMR master rates for 2013 with escalations. The 2013 rates were updated to 2015 using the inflation of 5.7% year on year.

The Lylyveld North Dump expansion was grouped with the current dump. The closure cost is therefore for the whole dump. The closure of this dump is already provided for as part of the mine's closure funding (trust fund and bank guarantees).

The next detailed update of Sishen Mine's closure cost will be done in 2015, of which the Lylyveld project will form part of. The updated assessment will be submitted to the DMR once completed.

11.2 Confirm that this amount can be provided for from operating expenditure

Sishen Mine makes financial provision for closure by means of the KIO Rehabilitation Trust Fund, with any shortfall between the immediate closure cost estimate and the balance in the Trust Account being funded by means of bank guarantees.

These reviews are done annually.

11.3 Specific Information required by the competent Authority

11.3.1 Impact on the socio-economic conditions of any directly affected person

Please refer to Section 10.4

11.3.2 Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act

Please refer to Section 10.4

11.3.3 Other matters required in terms of sections 24(4)(a) and (b) of the Act

Please refer to Section 7

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

12. DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME.

12.1 Details of the EAP

Name of The Practitioner: Exigo Sustainability (Pty) Ltd

Tel No.: 012 751 2160

Fax No. : 086 607 2406

e-mail address: michael@exigo3.com

EAP	Qualifications	Years' experience
Mr. Michael Grobler	BSc Hons. Conservation Ecology. M. OL - Pr.Sci.Nat;	11 years
Mrs Reneé Kruger	M. Environmental Management	7 years

CV's with experience is attached as APPENDIX A: CV'S OF THE EAP TEAM.

12.2 Description of the Aspects of the Activity

12.2.1 Lylyveld North Expansion of Waste Rock Residue Deposit

Lylyveld North has an existing Waste Rock Residue Deposit (WRRD). The dump was created in the 1980's. It has however become evident that additional dumping space needs to be created for approximately 1,480,000m3 of waste rock coming from the 30m eastern pit wall pushback. Only 130 000m³ can be absorbed by the haul road and safety berms, therefore justifying a need to expand the existing waste rock.

The total expansion footprint will be approximately 5ha. Indigenous vegetation clearance will be required as well as a waste licence for the expansion of a waste facility.

Water will be sourced from existing sources as authorised in the current water use licence.

3.2 Lylyveld Haul Road Expansion over the farm Bruce

SIOC wants to construct a new haul road over land belonging to a neighbouring (Khumani) mining company. The two companies are in process of sorting out the contractual agreements.

The proposed road over Khumani's property will be 30m x 1800m and will be an extension of the current Lylyveld North Haul Road (Figure 7). Waste rock will be used for the road base construction. The current Lylyveld North haul road and the proposed extension over Khumani will cater for Komatsu 795 trucks that will be used to transport ore from Lylyveld North to Sishen Mine. A photo of the current Lylyveld North haul road is displayed in Figure 5.

Indigenous vegetation will have to be cleared for the purpose of constructing the proposed road.

The construction of the Lylyveld North haul road was previously approved by the Department of Environment and Nature Conservation in in May 2013. An amendment was granted in 2015 for a deviation of the haul road (see Figure 4)

12.3 Composite Map

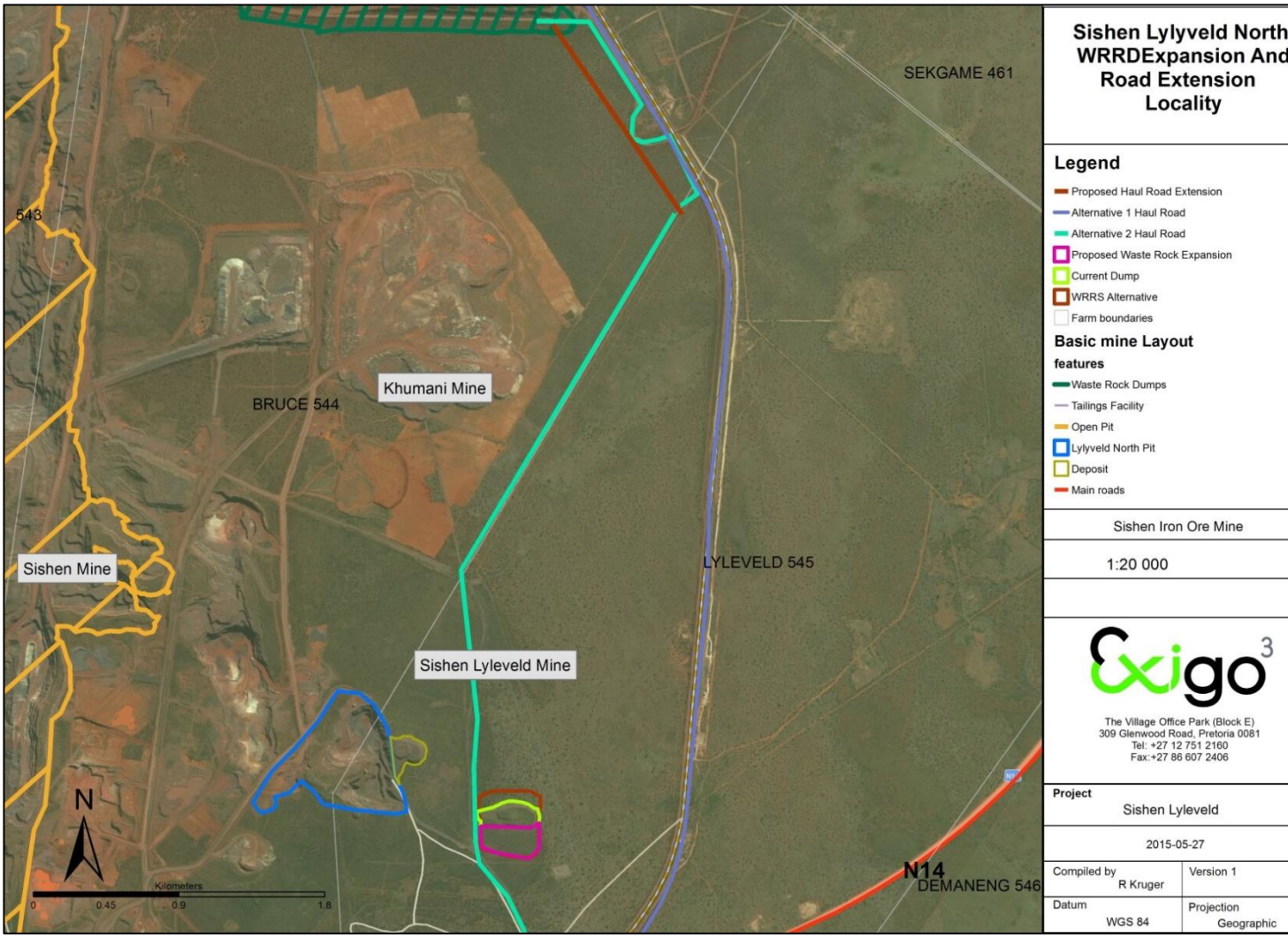


Figure 26: Composite Map

12.4 Description of Impact management objectives including management statements

Please refer to Table 16. Also note the following objectives for the project:

- Not to harm ecologically sensitive areas

- Not to pollute the groundwater resource
- Not to pollute the surface water resource
- To manage the Residue dump according to the SIOC Code of Practice
- To reduce the cumulative air quality of the mine by staying within the standards prescribed
- Not to impact on sites of Archaeological importance
- To enhance the socio-economic status of the surrounding area
- To provide a safe environment for workers to work in

12.4.1 Determination of closure objectives

A closure vision and closure objectives were developed for Sishen Mine as part of the Sishen Closure Plan process. The Sishen Closure Vision aims to make sure the Sishen zone of influence is a safe, stable, non-polluting and healthy environment with predominantly grazing potential supporting small-scale, socio-economic enterprises. Following from the closure vision, closure objectives can be defined. The primary objective for closure is to strive towards achieving closure that will be widely accepted and cost-effective for the Mine. The more important closure objectives relevant to the rehabilitation of the mine are as follows:

- A walk-away solution for closure with limited to non-significant long-term liabilities that require management.
- Rehabilitation is of a high quality and must be sustainable into the predictable future.
- Proposed post-closure land-uses are sustainable.
- Legal compliance has been achieved.
- Authorities will be satisfied with the extent of rehabilitation and closure criteria.
- The DMR will be satisfied to issue a closure certificate with limited or no significant conditions attached.
- That ground and surface water will not be polluted once the mine is closed.
- That all land rehabilitated is safe and useable, similar to the pre-mining situation.
- The rehabilitated land must be physically and chemically stable.
- The safety zone of the open pit is established and suitable measures taken to prohibit access.
- The Mine residue sites (waste rock, plant discard and slimes) and pit area must be made safe and stable and be utilised as waste land.

The post-closure land-use options for the mine residue sites are linked to the closure vision and objectives and include the following:

- Game and cattle farming.
- The mine residue sites must be made safe and stable (grazing not included on residue sites).
- Allow industrial activity post closure in the mining area, where appropriate.
- Small-scale, socio-economic business opportunities can be implemented.

12.4.2 Volumes and rate of water use required for the operation

Water to be used at the site will fall in the approved water rates in the approved water use licence of the mine.

12.4.3 Has a water use licence been applied for?

N/A. The Waste rock dump as well as water use is covered under the 2015 approved WUL (refer to Appendix E.

12.5 Impacts to be mitigated in their respective phases

Measures to rehabilitate the environment affected by the undertaking of any listed activity

Table 16: Impacts to be mitigated in their respective phases

No	Activity/Aspect	Impact	Phase	Proposed Mitigation/management measures	Areas applicable and the size of area	Responsible Party	Scheduling	Compliance with standards/Acts or Anglo management tools
Ecological Impacts								
Objective: Not to harm ecologically sensitive areas and to restrict ecological impacts to a minimum								
1	Clearing of vegetation for construction activities, construction of infrastructure, access roads etc. Habitat destruction	Habitat destruction	Construction	• The removal of the indigenous trees and shrubs should only occur on the footprint area of the proposed haul road and WRD footprint and not over the larger area. No trees may be trimmed or removed without the prior permission of the project manager or Environmental Control Officer (ECO). • Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area. • Monitoring should be implemented during the construction phase of the development to ensure that minimal impact is caused to the fauna of the area. • The ECO should advise the construction team in all relevant	All Areas (6.5 Ha)	Environmental Department	Throughout construction phase	The National Forest Act (Act 84 of 1998)

				matters to ensure minimum destruction and damage to the environment. The ECO should enforce any measures that he/she deem necessary. Regular environmental training should be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation. • Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist				
2	Clearing of vegetation for development footprints, construction of infrastructure, access roads etc.	Habitat fragmentation	Construction	• Use existing facilities (e.g., access roads, degraded areas) to the extent possible to minimize the amount of new disturbance. • Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. All possible efforts must be made to ensure as little disturbance as possible to the sensitive habitats on site during construction; • Where necessary and feasible, the construction of landscaped culverts to a depth of 300 mm will allow the free movement for small mammals, reptiles and amphibians from one side of the				

				haul routes to the other. These will need to be maintained throughout the operational phase and beyond; • Where necessary and feasible, berms, low walling or fencing could be constructed in order to guide animals towards these culverts to promote the use of the abovementioned passageways; • During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place. Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas				
3	Exposure of soils to rainfall and wind during construction	Soil erosion	Construction	• Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices. Control dust on construction sites and access roads using water-sprayers. • Institute a storm water management plan including strategies such as: o minimising impervious area o increasing infiltration to soil by				GN704 and the DWA Best Practices (DWA, 2006a)

				use of recharge areas • Have permanent erosion control plans that focus on the establishment of stable native vegetation communities. • Ensure the amount of bare soil exposed is minimized by staging earthworks in phases and leaving as much ground cover intact as possible during construction. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from construction activities. • Any topsoil dumps should not be compacted, nor should any object be placed or deposited upon it, as far as possible				
4	Movement of vehicles on site during construction	Spillage of harmful substances	Construction	• Water falling on areas polluted with oil/diesel or other hazardous substances must be contained. Any excess or waste material or chemicals should be removed from the site and discarded in an environmental friendly way. The ECO should enforce this rule rigorously. • Chemicals to be stored on an impervious surface protected from rainfall and storm water run-off. • Polluted soils must be removed to the bioremediation facility or treated in situ where it is difficult to remove. If it is not possible to contain the spill, the site needs to be closed off and a full site assessment needs to be				

				undertaken (relevant specialist advice to be obtained prior to the activities on-site being ceased). • Ensure that refuelling stations on site are constructed so as to prevent spillage of fuel or oil onto the soil, and put in place measures to ensure that any accidental spillages can be contained and cleaned up promptly. • Sewage should either be treated in a suitable plant or removed from the site for treatment elsewhere. • Spill kits should be on-hand to deal with spills immediately; • Spillages or leakages must be treated according to an applicable procedure as determined by a plan of action for the specific type of disturbance; • All construction vehicles should be inspected for oil and fuel leaks regularly and frequently. Vehicle maintenance will not be done on site except in emergency situations in which case mobile drip trays will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier				
5	Continued movement of personnel and vehicles on and off the site during the construction phase, as well as occasional delivery of materials	Spread of alien invasive species	Construction	• Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage				The National Forest Act (Act 84 of 1998)

	required for maintenance			and most easily able to establish. • Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. • Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented.				
6	Construction of waste rock dump and haul road	Negative effect of human activities on flora	Construction	• Adequate rubbish bins and sanitation facilities should be provided. • The ECO should regularly inspect the site, including storage facilities and compounds and eradicate any invasive or exotic plants and animals. • Maintain proper firebreaks around entire development footprint. • Educate construction workers regarding risks and correct disposal of cigarettes. • More fauna are normally killed the faster vehicles travel. A speed limit should be enforced (preferably 60 km/hour). • Travelling at night should be avoided or limited as much as possible.				
7	Exposure of soils to rainfall and wind during construction	Dust contamination	Construction	• Dust suppression must be undertaken in conjunction with a dust monitoring programme comprising of dust buckets, high volume active air samplers or				

				continuous particle monitors or even personal exposure samplers at generation sites, around the mine and in adjacent areas. An air quality management programme must be implemented to ensure compliance with the National Environmental Management: Air Quality Act 39 of 2004. These should be monitored regularly to ascertain the dust load and emission rates and particle size distribution; • Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation. • A speed limit (preferably 60 km/hour) should be enforced on dirt roads				
Groundwater								
Objective: Not to pollute the groundwater resource								
8	Contamination of groundwater from leaching of stockpiled rock and soil	Ground Water Pollution	Construction	• Latrines should be kept away from sensitive areas with direct access to groundwater, such as boreholes and drainage lines. Portable latrines should be sealed units that can be cleaned	All areas	Environmental Department /Mining department	Throughout construction phase	GN704 and the DWA Best Practices (DWA, 2006a)
9	Contamination of groundwater from fuel leaks from vehicles and storage	Ground Water Pollution	Construction			Environmental Department /Mining		

				by truck and the waste must be taken to a suitable sewage facility for treatment. They should be well maintained and regularly cleaned and sewage should not be allowed to directly access the groundwater or surface water systems • Any deposited soil and rock should have storm water management measures implemented • Groundwater monitoring must take place at the groundwater monitoring localities specified by the DWA WUL • Groundwater monitoring programme to be reviewed annually and changes made if required to ensure optimised monitoring program • Ongoing pollution source identification and management should take place • The overburden and waste dumps should be designed for concurrent rehabilitation and runoff should be contained in toe paddocks and storm water containment dams according to GN704 and the DWA Best Practices (DWA, 2006a)		department		
10	Contamination of groundwater from Waste Rock Dump (WRD) leachate	Ground Water Pollution	Operation			Environmental Department /Water department	As per current monitoring protocol	
Surface water								
Objective: Not to pollute the surface water resource								

12	Contamination of surface water from stockpiled rock and soil	Surface water pollution	Construction/ Operation	• Stormwater management systems should be implemented and maintained according to GN 704 principles. • Dirty areas will be isolated and pollution managed and reduced at the source. The 1:50 year flood event will be catered for. • Hazardous substances must be managed in accordance with Sishen Mine procedures • No bins containing organic solvents such as paint and thinners shall be cleaned on the mine • Chemicals and oil storage facilities must be bunded • Construction vehicles and machines must be maintained properly and regularly to ensure that hydrocarbon spillages are kept to a minimum • Hydrocarbon spills shall be contained through the use of soil, Safsorb or any other suitable dry material. • Spill kits must be easily accessible at operations where there is a risk for hydrocarbon spillage • Provide bins for construction workers at appropriate positions for disposal of domestic waste • Conduct an awareness and training programme to reinforce sound environmental principles with regard to waste management and water	Waste rock dump area (5.0Ha)	Environmental And Mining Departments	Throughout the life of mine	GN704 and the DWA Best Practices (DWA, 2006a)

				pollution				
13	Contamination of surface water arising from run-off from waste dumps	Surface water pollution	Construction/ Operation	• Environmental related incidents must be reported to the SHEQ department				
Topography								
Objective: To manage the Residue dump according to the SIOC Code of Practice								
14	Altering the existing topography of the site	Deposition of waste and overburden materials in dumps	Construction/ Operation	• All waste rock dumps will be managed according to the SIOM Code of practice (COP) on mine residue deposits. • In order to minimise the impact on the topography, the following measures will be implemented: o Where waste rock dumps occur which cannot economically be returned to the pit, these will be shaped to ensure a stable and self-sustainable slope (24°). o Ongoing projects to optimally utilise the resource will be employed to minimise the placing of waste material on surface. o Concurrent rehabilitation will take place as far as possible in order to mitigate the topographical impact. o On-going rehabilitation and vegetation of the impacted areas must be done as far as possible . o Locate storm water diversion trenches to have the minimum impact on topography.	Waste rock dump area (5.0Ha)	Environmental And Mining Departments	Throughout the life of mine	SIOM Code of Practice for Mine residue deposits
Air quality								
Objective: To reduce the cumulative air quality of the mine by staying within the standards prescribed								
15	Pollution from Dust and PM10 at	Air pollution	Construction	• In order to reduce vehicle	All areas	Environmental	Throughout	National

	sensitive receptors - Project on it own			entrained dust the mitigation measures include: o Unpaved roads should be properly maintained by grading and shaping to prevent dust generation caused by excessive road surface wear. o For haul roads water and where practically possible water sprays in combination with chemicals will be applied. o Wet or chemical suppression of unpaved areas will be applied continuously as part of the continuous road maintenance and dust suppression standards o Inspect road integrity and repair frequently. • Measures to reduce dust pollution from deposits include: o A chemical (but bio-degradable and non-toxic) dust suppressant can also be used if needed. • Compliance monitors, for measuring PM levels should be implemented at the main residential areas of Kathu, Sesheng and Dingleton o Regular monitoring of PM10 and PM2.5and dust fallout around the mine, should take place to test for compliance to regulations. During transportation of waste rock the following mitigation can be applied: • Apply water, or a mixture of water and chemicals for dust suppression on mine haul roads,		And Mining Departments	the life of mine	Ambient Air Quality Standards
16	Pollution from Dust and PM10 at sensitive receptors - Project on it own	Air pollution	Operation					
17	Pollution from PM10 at sensitive receptors - **Cumulative** impact	Air pollution	Construction				Throughout the life of mine	
18	Pollution from PM10 at sensitive receptors - **Cumulative** impact	Air pollution	Operation		All areas	Environmental And Mining Departments		National Ambient Air Quality Standards

				• Chemical treatment of permanent roads. • Proper maintenance of transport vehicles o Speed limit on on-site roads o Optimizing haulage distances to be as short as possible o It is desirable to plan the waste rock dump rehabilitation to occur as early as possible in the life of the mine. Establishing the final faces of waste rock dumps early and re-vegetating these surfaces will significantly reduce wind erosion.				
Heritage Impacts								
Objective: Not to impact on sites of Archaeological importance								
19	Destruction of site of Archaeological importance	Construction activities	Construction	A careful watching brief monitoring process is recommended whereby an informed ECO inspect the construction sites on regular basis in order to monitor possible impact on heritage resources. Should any subsurface paleontological, archaeological or historical material or heritage resources be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately	All Areas	Environmental Department	Throughout construction	National Heritage Resources Act No 25 of 1999, section 35
Social Impacts								
Objective: To enhance the socio-economic status of the surrounding area								
20	Job creation or maintaining (Positive)	Economic Impact	Construction/ Operation	• • The mine should seek to employ people from the local communities to improve the unemployment situation in the	All areas	HR Department	Throughout the life of mine	No standards

				area and preference should ideally be given to town and communities with the greatest unemployment levels such as Deben, Olifantshoek, Dingleton, and Sesheng • The mine should continue increasing its procurement practices from local and BEE enterprises to increase the positive impact in the local economy				
Safety Impacts								
Objective: To provide a safe environment for workers to work in								
21	Safety of Transnet workers (Positive)	Safety impact	Operation	The Transnet service road must be given back to Transnet and the road not used for mining activities	Haul Road	HR Department	Throughout the life of mine	Mine Health and Safety

12.6 Impact Management Outcomes

(A description of impact management outcomes, identifying the standard of impact management required for the aspects contemplated in paragraph;

Please refer to Table 16

12.7 Impact Management Actions

(A description of impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (c) and (d) will be achieved).

Please refer to Table 16

12.8 Financial Provision

12.8.1 Determination of the amount of Financial Provision.

Please refer to section 11. The financial provision was determined using the master rates from 2013 and escalating the amount by 5.7% per year up to 2015.

Table 17: Calculation of the Quantum

CALCULATION OF THE QUANTUM

Mine: Sishen Lyleveld Waste rock dump expansion and Haul road extension — **Location:**

Evaluators: R Kruger — **Date:** 12/05/2015

Risk Class	C
Area Sensitivity	MEDIUM

No.	Description	Unit	A	B	C	D	E=A*B*C*D
			Quantity	Master rate 2015	Multiplication factor	Weighting factor 1	Amount (rands)
1	Dismantling of **processing plant and related structures** (including overland conveyors and powerlines)	m3	0.00	12.25	1.00	1.00	0.00
2(A)	Demolition of **steel buildings and structures**	m2	0.00	170.58	1.00	1.00	0.00
2(B)	Demolition of **reinforced concrete buildings and structures**	m2	0.00	251.38	1.00	1.00	0.00
3	Rehabilitation of **access roads**	m2	45000.00	30.52	1.00	1.00	1229400.00
4(A)	Demolition and rehabilitation of **electrified railway lines**	m	0.00	296.27	1.00	1.00	0.00
4(B)	Demolition and rehabilitation of **non-electrified railway lines**	m	0.00	161.61	1.00	1.00	0.00
5	Demolition of **housing and/or administration facilities**	m2	0.00	341.16	1.00	1.00	0.00
6	**Opencast rehabilitation** including final voids and ramps	ha	0.00	173635.56	1.00	1.00	0.00
7	Sealing of **shafts, adits and inclines (boreholes)**	m3	0.00	91.58	1.00	1.00	0.00
8(A)	Rehabilitation of **overburden and spoils**	ha	0.00	119228.55	1.00	1.00	0.00
8(B)	Rehabilitation of processing waste **deposits and evaporation ponds (basic salt-producing waste)**	ha	0.00	148497.01	1.00	1.00	0.00
8(C)	Rehabilitation of processing waste **deposits and evaporation ponds (acidic, metal-rich waste)**	ha	11.00	431305.69	1.00	1.00	4744362.55
9	Rehabilitation of **subsided areas**	ha	0.00	99835.95	1.00	1.00	0.00
10	**General surface rehabilitation**	ha	0.00	94449.12	1.00	1.00	0.00
11	River diversions	ha	0.00	94449.12	1.00	1.00	0.00
12	Fencing	m	0.00	107.74	1.00	1.00	0.00
13	**Water management**	ha	0.00	35912.22	1.00	1.00	0.00
14	2 to 3 years of **maintenance and aftercare**	ha	0.00	1256.93	1.00	1.00	0.00
15A	Specialist study	Sum	0.00	0.00	1.00	1.00	
15B	Specialist studies (soil remediation)	ha	0.00	0.00	1.00	1.00	0.00
					SubTotal 1		**5 973 763**
			(Sum of items 1 to 15 above)				
	Preliminary and General	6.0%	if Subtotal 1 > 100 000 00		Weighting factor 2		
		12.0%	if Subtotal 1 < 100 000 000			1.00	716 852
	Contingency		10.0%				597 376
					SubTotal 2		**7 287 990**
			(Subtotal 1 plus sum of management and contingency)				
					Add Vat (14%)		1 020 319
					GRAND TOTAL		**8 308 308.96**
					(Subtotal 2 plus VAT)		

12.8.1.1 Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under the Regulation.

Sishen Closure Vision

The SIOC closure plans and the associated financial provision on the closure objectives, goals and requirements as identified in the Global Sishen Closure Plan (2008), findings of the specialist studies conducted, AA Mine Closure Toolbox and the Anglo Environment Way. These objectives, goals and requirements are identified below:

- Safety and health of people and animals are safeguarded from hazards resulting from the suspended mining operations;
- Environmental damage or residual environmental impacts are minimised to the extent that they are acceptable to all parties involved;
- The land is rehabilitated to achieve a condition approximating its natural state, or so that the envisaged end use of the land can be achieved;
- The physical and chemical stability of the remaining structures should be such that risk to the environment through naturally occurring forces is eliminated;
- Mine closure is achieved efficiently, cost effectively, and in compliance with the laws of South Africa;
- The social impacts resulting from mine closure are managed in such a way that establishment of a socially stable community in line with the principles of sustainable development is facilitated.
- The Sishen closure vision is to make sure the Sishen zone of influence is a safe, stable, non–polluting and healthy environment with predominately grazing potential supporting small scale socio-economic enterprises.

12.8.1.2 Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties.

Sishen has presented the closure objectives to interested parties on various occasions and in various EMPr reports.

12.8.1.3 Provide a rehabilitation plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure.

Please refer to Figure 3 and Figure 7.

12.8.1.4 Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives.

Refer to Section 12.8.1.1

12.8.1.5 Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline.

Please refer to Section 11

12.8.1.6 Confirm that the financial provision will be provided as determined.

This report is constitutes additional infrastructure and is not for a new mining project.

However Sishen Mine is in regular communication with the DMR regarding the required updates to its financial provision.

A Bank guarantee will be provided for the project.

After the 2015 detailed closure assessment any shortfalls between the estimated closure cost and the overall closure cost calculated will then be covered by means of bank guarantees.

12.9 Mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon, including

According to the MPRDA Regulations (Regulation 51b (iv)), an EMPR must contain the planned program for monitoring and EMPR performance assessments. The monitoring program in Table 18 below will be implemented by Sishen Mine:

Table 18: Monitoring Programme

No	Environmental component	Frequency of monitoring	Frequency of reporting
1	EMPR performance assessment (internal)	Compliance with the approved EMPR will be audited internally by the Environmental Manager on a annual basis. Ad-hoc audits will be undertaken by the Environmental Department.	Records of internal audits will be retained.
2	EMPR performance assessment (external)	The MPRDA Regulations (Regulation 55) states that the frequency of performance assessment reporting shall be in accordance with the period specified in the approved EMPR, every 2 years or as agreed in writing by the Minister. This performance assessment will be undertaken by an independent third party	A formal EMPR Performance Evaluation Report will be submitted to the DMR every 2 years
3	Water quantity & quality monitoring	Monitoring of surface and ground water resources will take place according to the DWA IWUL. The current water quality monitoring network is shown in Figure 10 The mine's water quality monitoring is conducted by an external consultant	Water quantity & quality monitoring results will be reported to DWA as per the IWUL requirements. These results will be reported to DMR on an annual basis
4	Environmental noise monitoring	An environmental baseline noise survey will be undertaken on an annual basis at sensitive noise receptor areas around	Noise baseline survey to be submitted to DMR on annual basis

		the mine, or alternatively, when new expansion projects are planned. The annually noise survey will be undertaken by an external consultant	
5	Vibration and air blast monitoring	The vibration and air blast arising from all blasts at Sishen Mine is monitored by an external consultant	Blast and air blast data will be reported to DMR on an annual basis
6	Rehabilitation progress monitoring	Rehabilitation will be undertaken in accordance with the mine's 5-Year Rehabilitation Plan	Progress made with the implementation of the 5-Year Rehabilitation Plan will be reported to DMR on an annual basis
7	Air Quality Monitoring	The mine's air quality monitoring program comprises of PM_{10} and dust fallout monitoring. PM_{10} monitoring is by means of permanently mounted particulate monitors that sends data to an online database. In 2014 the mine will also implement $PM_{2.5}$ monitoring and an asbestos monitoring program	Air quality monitoring results will be reported to DMR and DEA on an annual basis
8	Biodiversity Monitoring	Biodiversity monitoring will be undertaken according to the biomonitoring protocol. Biodiversity monitoring will be undertaken jointly by the mine and external consultants	Biodiversity monitoring results will be reported to DMR on an annual basis
9	Topsoil monitoring	The volumes of topsoil removed, deposited and used for rehabilitation will be recorded	Topsoil volumes will be reported to DMR on an annual basis
10	Contaminated soil monitoring	The volumes of contaminated soil generated, deposited, treated, disposed, etc. will be recorded	Contaminated soil volumes will be reported to DMR on an annual basis
11	Progress with implementation of storm water management plan	The Department of Water and Sanitation approved the mines SWMP. Implementation to start 2016	Progress with implementation of the mine's storm water plan will be reported to DMR and DWA on an annual basis
12	EMS audits (internal)	Internal EMS audits will be undertaken by a team of internal auditors according to a yearly audit schedule	Records of internal EMS audits will be retained at the mine
13	EMS audits (external)	An external EMS audit will be undertaken by an independent third party on an annual basis	Records of external EMS audits will be retained at the mine
14	Legal compliance audits	An external legal compliance audit will	Records of external legal audits will

	(external)	be undertaken by an independent third party on a bi- annual basis. Applicable legislation to be considered include those listed in section 3	be retained at the mine
15	IWUL performance audit (external)	An external IWUL performance audit will be undertaken by an independent third party on an annual basis	The outcomes of the IWUL performance audit will be submitted to DWA and DMR on an annual basis

12.10 Indicate the frequency of the submission of the performance assessment/ environmental audit report.

Table 19: Frequency of the submission of the performance assessment/ environmental audit report

No	Environmental component	Frequency of monitoring	Frequency of reporting
1	EMPR performance assessment (internal)	Compliance with the approved EMPR will be audited internally by the Environmental Manager on an annual basis. Ad-hoc audits will be undertaken by the Environmental Department.	Records of internal audits will be retained.
2	EMPR performance assessment (external)	The MPRDA Regulations (Regulation 55) states that the frequency of performance assessment reporting shall be in accordance with the period specified in the approved EMPR, every 2 years or as agreed in writing by the Minister. This performance assessment will be undertaken by an independent third party	A formal EMPR Performance Evaluation Report will be submitted to the DMR every 2 years

12.11 Environmental Awareness Plan

12.11.1 Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work

Sishen Mine has established a program for SHEQ competence, training and awareness. The procedure is revised from time-to-time as deemed appropriate by the mine. Environmental awareness training at Sishen Mine takes place in accordance with this procedure. Three levels of training have been identified in the procedure, namely general awareness training, job specific training and competency training. All employees receives SHEQ awareness training through the mine's e-learning system. Training for specific operations is based on the risk-based needs of a specific section and environmental awareness modules are used for this purpose.

12.11.2 Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment.

SIOM developed and implemented an Environmental Management System (EMS) that complies with the requirements of ISO14001:2004 Environmental Management Systems and is certified by the South African Bureau of Standards. Surveillance audits are conducted annually and recertification audits every third year. The mine's EMS addresses the following elements of the ISO14001 standard and these, in conjunction with the environmental commitments in section 10.5, ensure that potential environmental impacts arising from the mine's activities are managed appropriately:

- An environmental policy that includes commitments to prevent pollution, comply with applicable legal requirements and provides a framework for setting environmental objectives and targets
- A register of environmental aspects and impacts with a view to implementing operational control measures to limit environmental impacts
- A register of all applicable legal requirements to ensure legal compliance
- A register of environmental objectives and targets that is consistent with the environmental policy and takes into account significant environmental impact and the management thereof, together with a program for achieving the identified objectives and targets
- Resources to ensure implementation of the EMS
- An environmental training and awareness program to ensure that persons performing tasks that could cause significant environmental impacts are aware of such impacts and are competent to perform such tasks
- A communication procedure for internal and external communication in respect of significant environmental aspects
- All Environmental Management System Documentation, as required by the ISO14001 standard, which includes control procedures for documents and records

- Operational control procedures for activities that could cause significant environmental impact to ensure that correct procedures are implemented to minimise potential environmental impacts
- An emergency preparedness and response procedure that identifies potential emergency situations and potential accidents that can impact on the environment to ensure that such situations are dealt with in an appropriate manner
- An environmental monitoring and measurement program to monitor and measure the key characteristics of the operation that can cause significant environmental impact and to gauge the success of implemented mitigation measures
- A procedure for periodically evaluating compliance with applicable legal requirements
- A procedure for dealing with non-conformities in terms of their identification, corrective action and preventative action
- Audit programs and procedures that makes provision for internal and external audits focussing on implementation of the requirements of the EMS and legal requirements
- Management reviews undertaken at planned intervals to ensure the system's continuing suitability, adequacy and effectiveness

Within the context of the principles listed above, the long term sustainability objectives of the Mine are:

- To avoid impacts by effective planning in order to prevent and limit possible impacts.
- To minimize impacts by implementing decisions or activities that are designed to reduce the undesirable impact on the bio-physical and socio-economic aspects detailed in the previous sections.
- Rectifying impacts by rehabilitating or restoring, where applicable, the affected environment. This will include attempts at habitat re-creation, and restoring the land to the natural pre-mining land uses or to a pre-determine and approved land use

The Environmental policy is described below.

Sishen Mine has established an environmental policy that is consistent with the requirements of the ISO14001 standard. With this policy Sishen Mine commits to develop, implement and maintain an Environmental Management System aimed at achieving:

- Upholding of our vision of Zero Harm and the principles of a Zero Mindset, No Repeats and Simple Non-Negotiable Standards
- Ongoing identification, assessment and effective management of SHEQ risks and impacts
- Proactive consideration of SHEQ issues in their planning and decision making
- Compliance with all applicable SHEQ legislation, international obligations, standards and other requirements to which they subscribe
- Establishment of objectives, targets and improvement plans to continuously improve their performance
- Provision of adequate resources to ensure a safe and healthy workplace for their employees and contractors, the maintenance of responsible environmental standards; as well as to

provide quality products and services that comply with and/or exceed customer expectations and ensure customer satisfaction through superior production processes

- Empowering their people through communication, coaching and training to ensure competence in SHEQ management
- Consultation with internal and external stakeholders on relevant matters relating to SHEQ
- Reporting, investigating and learning from incidents by determining contributing factors and implementing corrective and preventive action to ensure the effectiveness of controls
- Prevention, reduction and management identified significant environmental aspects such as use of water, energy, hydrocarbon substances (prevention of pollution), biodiversity, wastes, generation of dust and noise; as well as the efficient use and conservation of natural resources
- Continual improvement of their SHEQ management systems and performance

12.12 Specific information required by the Competent Authority

(Among others, confirm that the financial provision will be reviewed annually).

Sishen Mine makes financial provision for closure by means of the KIO Rehabilitation Trust Fund, with any shortfall between the immediate closure cost estimate and the balance in the Trust Account being funded by means of bank guarantees. The last annual review of the financial quantum in terms of section 41(3) and Regulation 54 of the MPRDA was submitted to DMR in December 2014. The mine will submit similar reviews on an annual basis.

13. **UNDERTAKING**

The EAP herewith confirms

i) the correctness of the information provided in the reports ☒

ii) the inclusion of comments and inputs from stakeholders and I&APs ; ☒

iii) the inclusion of inputs and recommendations from the specialist reports where relevant; ☒and

iv) that the information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected. parties are correctly reflected herein. ☒

Signature of the environmental assessment practitioner:

Name of company:

Date:

-END-

14. **APPENDIX A: CV'S OF THE EAP TEAM**

15. **APPENDIX B: PUBLIC PARTICIPATION**

16. **APPENDIX C: SPECIALIST STUDIES**

21.1 Appendix C.1 – Ecological Study

21.2 Appendix C.2 –Archaeological Study

21.3 Appendix C.3 –Leach Assessment Study

17. APPENDIX D: IMPACT ASSESSMENT TABLE

No	Activity/Aspect	Impact	Phase	WM/ WOM	Probability		Duration		Scale		Magnitude		Significance (WOM)		Proposed Mitigation/management measures	Significance (WM)		Areas applicable and the size of area	Responsible Party	Scheduling	Compliance with standards/Acts or Anglo management tools
Ecological Impacts																					
1	Clearing of vegetation for construction activities, construction of infrastructure, access roads etc. Habitat destruction	Habitat destruction	Construction	WOM	5	Definite	5	Permanent	1	Local	6	Medium	60	Moderate	• The removal of the indigenous trees and shrubs should only occur on the footprint area of the proposed haul road and WRD footprint and not over the larger area. No trees may be trimmed or removed without the prior permission of the project manager or Environmental Control Officer (ECO). • Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area. • Monitoring should be implemented during the construction phase of the development to ensure that minimal impact is caused to the fauna of the area. • The ECO should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. The ECO should enforce any measures that he/she deem necessary. Regular environmental training should be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation. • Poisons for the control of problem animals	35	Low	All Areas (6.5 Ha)	Environmental Department	Throughout construction phase	The National Forest Act (Act 84 of 1998)
				WM	5	Definite	4	Long Term	1	Local	2	Low									

															should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist						
2	Clearing of vegetation for development footprints, construction of infrastructure, access roads etc.	Habitat fragmentation	Construction	WOM	5	Definite	5	Permanent	1	Local	6	Medium	60	Moderate	• Use existing facilities (e.g., access roads, degraded areas) to the extent possible to minimize the amount of new disturbance. • Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. All possible efforts must be made to ensure as little disturbance as possible to the sensitive habitats on site during construction; • Where necessary and feasible, the construction of landscaped culverts to a depth of 300 mm will allow the free movement for small mammals, reptiles and amphibians from one side of the haul routes to the other. These will need to be maintained throughout the operational phase and beyond; • Where necessary and feasible, berms, low walling or fencing could be constructed in order to guide animals towards these culverts to promote the use of the abovementioned passageways; • During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving	35	Low				
				WM	5	Definite	4	Long Term	1	Local	2	Low									

														around in the veld or bulldozing natural habitat must not take place. Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas						
3	Exposure of soils to rainfall and wind during construction	Soil erosion	Construction	WOM	4	Highly Probable	4	Long Term	2	Site	6	Medium	48	Moderate	• Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices. Control dust on construction sites and access roads using water-sprayers. • Institute a storm water management plan including strategies such as: o minimising impervious area o increasing infiltration to soil by use of recharge areas • Have permanent erosion control plans that focus on the establishment of stable native vegetation communities. • Ensure the amount of bare soil exposed is minimized by staging earthworks in phases and leaving as much ground cover intact as possible during construction. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from construction activities. • Any topsoil dumps should not be compacted, nor should any object be placed or deposited upon it, as far as possible	28	Low				GN704 and the DWA Best Practices (DWA, 2006a)
				WM	4	Highly Probable	3	Medium Term	2	Site	2	Low								
4	Movement of vehicles on site during construction	Spillage of harmful substances	Construction	WOM	4	Highly Probable	4	Long Term	2	Site	6	Medium	48	Moderate	• Water falling on areas polluted with oil/diesel or other hazardous substances must be contained. Any excess or waste material or chemicals should be removed from the site	24	Low				
				WM	4	Highly Probable	3	Medium Term	1	Local	2	Low								

														and discarded in an environmental friendly way. The ECO should enforce this rule rigorously. • Chemicals to be stored on an impervious surface protected from rainfall and storm water run-off. • Polluted soils must be removed to the bioremediation facility or treated in situ where it is difficult to remove. If it is not possible to contain the spill, the site needs to be closed off and a full site assessment needs to be undertaken (relevant specialist advice to be obtained prior to the activities on-site being ceased). • Ensure that refuelling stations on site are constructed so as to prevent spillage of fuel or oil onto the soil, and put in place measures to ensure that any accidental spillages can						
														ensure that any accidental spillages can be contained and cleaned up promptly. • Sewage should either be treated in a suitable plant or removed from the site for treatment elsewhere. • Spill kits should be on-hand to deal with spills immediately; • Spillages or leakages must be treated according to an applicable procedure as determined by a plan of action for the specific type of disturbance; • All construction vehicles should be inspected for oil and fuel leaks regularly and frequently. Vehicle maintenance will not be done on site except in emergency situations in which case mobile drip trays will be used to capture any spills. Drip trays should be emptied into a holding tank and						

														returned to the supplier					
5	Continued movement of personnel and vehicles on and off the site during the construction phase, as well as occasional delivery of materials required for maintenance	Spread of alien invasive species	Construction	WOM	4	Highly Probable	4	Long Term	2	Site	6	Medium	48	Moderate	• Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish. • Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. • Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented.	24	Low				The National Forest Act (Act 84 of 1998)
				WM	4	Highly Probable	3	Medium Term	1	Local	2	Low							
6	Construction of waste rock dump and haul road	Negative effect of human activities on flora	Construction	WOM	4	Highly Probable	3	Medium Term	2	Site	6	Medium	44	Moderate	• Adequate rubbish bins and sanitation facilities should be provided. • The ECO should regularly inspect the site, including storage facilities and compounds and eradicate any invasive or exotic plants and animals. • Maintain proper firebreaks around entire development footprint. • Educate construction workers regarding risks and correct disposal of cigarettes. • More fauna are normally killed the faster vehicles travel. A speed limit should be enforced (preferably 60 km/hour). • Travelling at night should be avoided or limited as much as possible.	28	Low				
				WM	4	Highly Probable	3	Medium Term	2	Site	2	Low							
7	Exposure of soils to rainfall and wind during construction	Dust contamination	Construction	WOM	5	Definite	4	Long Term	2	Site	6	Medium	60	Moderate	• Dust suppression must be undertaken in conjunction with a dust monitoring programme comprising of dust buckets, high volume active air samplers or continuous particle	28	Low				
				WM	4	Highly Probable	3	Medium Term	2	Site	2	Low							

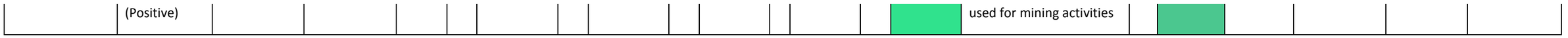
															monitors or even personal exposure samplers at generation sites, around the mine and in adjacent areas. An air quality management programme must be implemented to ensure compliance with the National Environmental Management: Air Quality Act 39 of 2004. These should be monitored regularly to ascertain the dust load and emission rates and particle size distribution; • Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation. A speed limit (preferably 60 km/hour) should be enforced on dirt roads					
Groundwater																				
8	Contamination of groundwater from leaching of stockpiled rock and soil	Ground Water Pollution	Construction	WOM	2	Probable	3	Medium Term	2	Site	6	Medium	22	Low	• Latrines should be kept away from sensitive areas with direct access to groundwater, such as boreholes and drainage lines. Portable latrines should be sealed units that can be cleaned by truck and the waste must be taken to a suitable sewage facility for treatment. They should be well maintained and regularly cleaned and sewage should not be allowed to directly access the groundwater or surface water systems • Any deposited soil and rock should have storm water management	7	Negligible	All areas	Environmental Department /Mining department	Throughout construction phase	GN704 and the DWA Best Practices (DWA, 2006a)
				WM	1	Improbable	3	Medium Term	2	Site	2	Low								
9	Contamination of groundwater from fuel leaks from vehicles and storage	Ground Water Pollution	Construction	WOM	2	Probable	1	Short Term	2	Site	6	Medium	18	Negligible		5	Negligible		Environmental Department /Mining department		
				WM	1	Improbable	1	Short Term	2	Site	2	Low								
10	Contamination of groundwater from Waste Rock Dump (WRD) leachate	Ground Water Pollution	Operation	WOM	2	Probable	4	Long Term	2	Site	6	Medium	24	Low		16	Negligible		Environmental Department /Water department	As per current monitoring protocol	
				WM	2	Probable	4	Long Term	2	Site	2	Low								

															measures implemented • Groundwater monitoring must take place at the groundwater monitoring localities specified by the DWA WUL • Groundwater monitoring programme to be reviewed annually and changes made if required to ensure optimised monitoring program • Ongoing pollution source identification and management should take place • The overburden and waste dumps should be designed for concurrent rehabilitation and runoff should be contained in toe paddocks and storm water containment dams according to GN704 and the DWA Best Practices (DWA, 2006a)						
Surface water																				
12	Contaminatio n of surface water from stockpiled rock and soil	Surface water pollution	Construction /Operation	WOM	2	Probable	4	Long Term	3	Regional	6	Medium	26	Low	• Stormwater management systems should be implemented and maintained according to GN 704 principles. • Dirty areas will be isolated and pollution managed and reduced at the source. The 1:50 year flood event will be catered for. • Hazardous substances must be managed in accordance with Sishen Mine procedures • No bins containing organic solvents such as paint and thinners shall be cleaned on the mine • Chemicals and oil storage facilities must be bunded • Construction vehicles and machines must be maintained properly and regularly to ensure that hydrocarbon spillages are kept to a minimum • Hydrocarbon spills shall be contained through the use of soil, Safsorb or any other suitable dry	9	Negligibl e	Waste rock dump area (5.0Ha)	Environment al And Mining Departments	Throughou t the life of mine	GN704 and the DWA Best Practices (DWA, 2006a)
				WM	1	Improbabl e	4	Long Term	3	Regional	2	Low								
13	Contaminatio n of surface water arising from run-off from waste dumps	Surface water pollution	Construction /Operation	WOM	2	Probable	4	Long Term	3	Regional	6	Medium	26	Low		9	Negligibl e				
				WM	1	Improbabl e	4	Long Term	3	Regional	2	Low								

														material. • Spill kits must be easily accessible at operations where there is a risk for hydrocarbon spillage • Provide bins for construction workers at appropriate positions for disposal of domestic waste • Conduct an awareness and training programme to reinforce sound environmental principles with regard to waste management and water pollution • Environmental related incidents must be reported to the SHEQ department						
Topography																				
14	Altering the existing topography of the site	Deposition of waste and overburden materials in dumps	Construction /Operation	WOM	5	Definite	3	Medium Term	3	Regional	6	Medium	60	Moderate	• All waste rock dumps will be managed according to the SIOM Code of practice (COP) on mine residue deposits. • In order to minimise the impact on the topography, the following measures will be implemented: o Where waste rock dumps occur which cannot economically be returned to the pit, these will be shaped to ensure a stable and self-sustainable slope (24°). o Ongoing projects to optimally utilise the resource will be employed to minimise the placing of waste material on surface. o Concurrent rehabilitation will take place as far as possible in order to mitigate the topographical impact. o On-going rehabilitation and vegetation of the impacted areas must be done as far as possible . o Locate storm water diversion trenches to have the minimum impact on topography.	40	Low	Waste rock dump area (5.0Ha)	Environmental And Mining Departments	Throughout the life of mine	SIOM Code of Practice for Mine residue deposits
				WM	5	Definite	3	Medium Term	3	Regional	2	Low								
Air quality																				

15	Pollution from Dust and PM10 at sensitive receptors - Project on it own	Air pollution	Construction	WOM	5	Definite	1	Short Term	3	Regional	6	Medium	50	Moderate	In order to reduce vehicle entrained dust the mitigation measures include: o Unpaved roads should be properly maintained by grading and shaping to prevent dust generation caused by excessive road surface wear. o For haul roads water and where practically possible water sprays in combination with chemicals will be applied. o Wet or chemical suppression of unpaved areas will be applied continuously as part of the continuous road maintenance and dust suppression standards o Inspect road integrity and repair frequently. • Measures to reduce dust pollution from deposits include: o A chemical (but bio-degradable and non-toxic) dust suppressant can also be used if needed. • Compliance monitors, for measuring PM levels should be implemented at the main residential areas of Kathu, Sesheng and Dingleton o Regular monitoring of PM10 and PM2.5and dust fallout around the mine, should take place to test for compliance to regulations. During transportation of waste rock the following mitigation can be applied: • Apply water, or a mixture of water and chemicals for dust suppression on mine haul roads, • Chemical treatment of permanent roads. • Proper maintenance of transport vehicles o Speed limit on on-site roads o Optimizing haulage distances to be as short as	24	Low	All areas	Environmental And Mining Departments	Throughout the life of mine	National Ambient Air Quality Standards
				WOM	4	Highly Probable	1	Short Term	3	Regional	2	Low									
16	Pollution from Dust and PM10 at sensitive receptors - Project on it own	Air pollution	Operation	WOM	5	Definite	3	Medium Term	3	Regional	6	Medium	60	Moderate		32	Low				
				WM	4	Highly Probable	3	Medium Term	3	Regional	2	Low									
17	Pollution from PM10 at sensitive receptors - **Cumulative** impact	Air pollution	Construction	WOM	5	Definite	1	Short Term	3	Regional	6	Medium	50	Moderate		30	Low	All areas	Environmental And Mining Departments	Throughout the life of mine	National Ambient Air Quality Standards
				WM	5	Definite	1	Short Term	3	Regional	2	Low									
18	Pollution from PM10 at sensitive receptors - **Cumulative** impact	Air pollution	Operation	WOM	5	Definite	4	Long Term	3	Regional	8	High	75	High		65	High				
				WM	5	Definite	4	Long Term	3	Regional	6	Medium									

															possible o It is desirable to plan the waste rock dump rehabilitation to occur as early as possible in the life of the mine. Establishing the final faces of waste rock dumps early and re-vegetating these surfaces will significantly reduce wind erosion.						
Heritage Impacts																				
19	Destruction of site of Archaeological importance	Construction activities	Construction	WOM WM	5 4	Definite Highly Probable	5 5	Permanent Permanent	1 1	Local Local	8 2	High Low	70	High	A careful watching brief monitoring process is recommended whereby an informed ECO inspect the construction sites on regular basis in order to monitor possible impact on heritage resources. Should any subsurface paleontological, archaeological or historical material or heritage resources be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately	32	Low	All Areas	Environmental Department	Through out construction	National Heritage Resources Act No 25 of 1999, section 35
Social Impacts																				
20	Job creation or maintaining (Positive)	Economic Impact	Construction /Operation	WOM WM	2 4	Probable Highly Probable	4 4	Long Term Long Term	1 1	Local Local	8 2	High Low	26	Low	• The mine should seek to employ people from the local communities to improve the unemployment situation in the area and preference should ideally be given to town and communities with the greatest unemployment levels such as Deben, Olifantshoek, Dingleton, and Sesheng • The mine should continue increasing its procurement practices from local and BEE enterprises to increase the positive impact in the local economy	28	Low	All areas	HR Department	Throughout the life of mine	No standards
Safety Impacts																				
21	Safety of Transnet workers	Safety impact	Operation	WOM WM	4 5	Highly Probable Definite	4 4	Long Term Long Term	3 3	Regional Regional	2 8	Low High	36	Low	The Transnet service road must be given back to Transnet and the road not	75	High	Haul Road	HR Department	Throughout the life of mine	Mine Health and Safety


(Positive)
used for mining activities

18. **APPENDIX E: SISHEN WATER USE LICENCE**

19. **REFERENCE LIST**

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