Sishen Iron Ore Company (Pty) Ltd: Sishen Iron Ore Mine

SISHEN WESTERN EXPANSION PROJECT: PHASE 2

Draft Environmental Impact Assessment Report and Environmental Management Programme Report

Report date: August 2021
Reference: 00202 MR 102

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Executive summary

Sishen Iron Ore Mine (Pty) Ltd ("SIOM") is operating under mining right number NC 5/3/2/106 MRC. SIOM is in the process of expanding its mining activities to the western side of the current mining pit area, this project referred in this document as the Sishen Western Expansion Project ("SWEP") Phase 2. The associated activities include the waste rock dump expansion and other infrastructure (HME Parkup, filling points, water lines, weighbridge, topsoil stockpile, product stockpile, haul roads, servitude road, fencing on the outside of the servitude road, relocation of electric powerlines, screening plant, ammonium nitrate silos, and culverts) that trigger several listed activities as forming part of this application.

The application for environmental authorisation and the final scoping report was submitted to the DMRE on 30 April 2021 and 11 June 2021, respectively. The application form was acknowledged by the DMRE on 27 July 2021 and the final scoping report accepted on 10 August 2021. This report is the Environmental Impact Assessment Report and Environmental Management Programme Report ("EIAR/EMPr") for the SWEP Phase 2.

The following listed activities are applied for:

Listed activity	Activity description
Listing Notice 1 (GNR 706 of GG 41766 of 13 July 2018)	
Activity 11	The installation of electric powerlines outside urban areas with a capacity of more than 33 but less than 275 kilovolts.
Activity 12	The construction of the HME Parkup area will be more than 100 square metres within 32 metres of a watercourse. The construction of a weighbridge will be more than 100 square metres and within 32 metres of a watercourse. The product stockpile with footprint of 65 hectares will be located within a watercourse. The construction of haul roads of 220 hectares. The construction of culverts within a watercourse.
Activity 19	The product stockpile with footprint of 65 hectares will be within the watercourse and requires infilling or deposition of material of more than 10 cubic metres in the watercourse. The construction of culverts will be within the watercourse and requires infilling or deposition of material of more than 10 cubic metres in the watercourse.
Activity 24	The construction of haul roads with a reserve wider than 13.5 meters.
Listing Notice 2 (GNR 325 of GG 40772 of 7 April 2017)	
Activity 4	The rapid reload bay for the temporary storage of high energy fuel ("HEF") as emulsion during the day with a storage capacity of more than 500 cubic metres. The construction and operation of ammonium nitrate silos of more than 500 cubic metres.
Activity 6	Activities as part of the Sishen Western Expansion Project: Phase 2 will require a Section 21 (c), (i) and (g) Water Use Licence ("WUL").
Activity 15	The clearance of an area of 20 hectares or more of indigenous vegetation, for the expansion of the Western Waste Rock Dump 5 and associated infrastructure.
Activity 17	Construction of a screening plant for screening of the plant by-product.
Listing Notice 3 (GNR 706 of GG 41766 of 13 July 2018)	

Listed activity	Activity description
Activity 4	The development of a road wider than 4 metres with a reserve less than 13.5 metres.
Activity 12	The clearance of an area of 300 square metres or more of indigenous vegetation for the expansion of the Western Waste Rock Dump 5 and associated infrastructure.
Activity 14	The construction of the HME Parkup area will be more than 10 square metres within 32 metres of a watercourse / pan. The construction of a weighbridge will be more than 100 square metres and within 32 metres of a watercourse. The product stockpile with footprint of 65 hectares is within a watercourse / pan. The construction of haul roads within a watercourse / pan. The construction of culverts within a watercourse / pan.

Listed activity	Activity description
Waste Management Activity (GN 921)	
Category A: Activity 13	The expansion of the Western Waste Rock Dump 5.

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PART A

SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1 Details of project applicant and environmental assessment practitioner

1.1. Details of the project applicant

Name of operation	Sishen Iron Ore Mine ("SIOM")
Applicant	Sishen Iron Ore Company (Pty) Ltd ("SIOC")
Postal address	Private Bag X506, Kathu, 8446
Responsible person	Nadia Williams
Telephone no.	053 739 2203
e-mail address	Nadia.williams@angloamerican.com
Company registration no.	2000/011085/07

1.2. Details of the environmental assessment practitioner

EAP	Shangoni Management Services (Pty) Ltd.: Lee-Anne Fellowes
Tel No	(012) 807 7036
Fax No	(012) 807 1014
e-mail Address	leeanne@shangoni.co.za

1.3. Expertise of the environmental assessment practitioner

Name and Surname	Qualifications and summary of experience
Lee-Anne Fellowes	Lee-Anne has a B-tech degree in Nature Conservation from the Tshwane University of Technology and holds a National Diploma in Nature Conservation. She gained valuable experience in the conservation and the environmental field through her employment at Gauteng's Department of Agriculture, Conservation and Environment for a period of 5 years. Her areas of expertise include alien invasive surveys & conservation plans, Environmental Impact Assessments (EIA), Environmental Management Programmes (EMP), Section 24G Rectification Applications, Basic Assessments, Water Use Licences and Project Management. Lee-Anne has 15 years' experience at Shangoni Management Services. Lee-Anne has been registered as a Professional Natural Scientist in the field of Conservation Science Registration number: 115574 and is registered as an

Name and Surname	Qualifications and summary of experience
	environmental impact assessment practitioner Registration number: 2019/850.

2 Description of the property

Table 1: Description of the properties applicable to the proposed activities

Farm name	**Expansion of the Western Waste Rock Dump 5** Portion 1 of the farm Gamagara 541 Portion 2 of the farm Gamagara 541	**Filling points** Portion 2 of the farm Gamagara 541 Portion 16 of the farm Sishen 543
	Ore stockpiles Portion 4 of the farm Gamagara 541 Portion 3 of the farm Gamagara 541 Remaining extent of the farm Gamagara 541 Portion 1 of the farm Gamagara 541	**Boundary fence and servitude road** Portion 4 of the farm Gamagara 541 Remaining extent of the farm Gamagara 541 Portion 1 of the farm Gamagara 541 Portion 2 of the farm Gamagara 541
	Relocation of powerlines Portion 4 of the farm Gamagara 541 Remaining extent of the farm Gamagara 541 Portion 1 of the farm Gamagara 541 Portion 2 of the farm Gamagara 541	**Screening plant** Portion 4 of the farm Gamagara 541
		HME Parkup and weighbridge Portion 1 of the farm Gamagara 541 Portion 13 of the farm Gamagara 541
	Silos (Ammonium nitrate) Remaining extent of the farm Sekgame 461	**Haul roads** Portion 1 of the farm Gamagara 541 Portion 2 of the farm Gamagara 541 Portion 13 of the farm Gamagara 541 Portion 12 of the farm Gamagara 541 Portion 16 of the farm Sishen 543 Portion 2 of the farm Sishen 543 Portion 1 of the farm Sishen 543
	Topsoil stockpile Portion 2 of the farm Gamagara 541	
	Rapid reload bay Portion 1 of the farm Gamagara 541 Portion 13 of the farm Gamagara 541	
Magisterial district	Gamagara Local Municipality, John Taolo Gaetsewe District Municipality	
Distance and direction from nearest town	8 km south-east from Kathu	
21-digit Surveyor General Code	**Expansion of the Western Waste Rock Dump 5** C04100000000054100001 C04100000000054100002	**Filling points** C04100000000054100002 C04100000000054300016

	Ore stockpiles C04100000000054100004 C04100000000054100003 C04100000000054100000 C04100000000054100001	**Boundary fence and servitude road** C04100000000054100004 C04100000000054100000 C04100000000054100001 C04100000000054100002
	Relocation of powerlines C04100000000054100004 C04100000000054100000 C04100000000054100001 C04100000000054100002	**Screening plant** C04100000000054100004 **HME Parkup and weighbridge** C04100000000054100001 C04100000000541000013
	Silos (Ammonium nitrate) C04100000000046100001	**Haul roads** C04100000000054100001 C04100000000054100002 C04100000000054100013 C04100000000054100012 C04100000000054300016 C04100000000054300002 C04100000000054300001
	Topsoil stockpile C04100000000054100002	
	Rapid reload bay (emulsion) C04100000000054100001 C04100000000054100013	

3 Locality of the project

Sishen Iron Ore Mine ("SIOM") falls within the administrative boundaries presented in the table below.

Table 2: Administrative boundaries

Province	Northern Cape Province
District municipality	John Taolo Gaetsewe District Municipality
Local municipality	Gamagara Local Municipality
Department of Mineral and Energy ("DMRE") Local Office and the Competent Authority ("CA")	DMRE (Kimberley)
Department of Water and Sanitation ("DWS") Local Office	DWS (Kimberley)
Department of Environmental Affairs and Nature Conservation ("DENC")	DENC (Kimberley)
Catchment zone	Orange River Catchment
Sub-catchments	D4
Water Management Area ("CMA")	Lower Vaal
Quaternary catchment	D41J

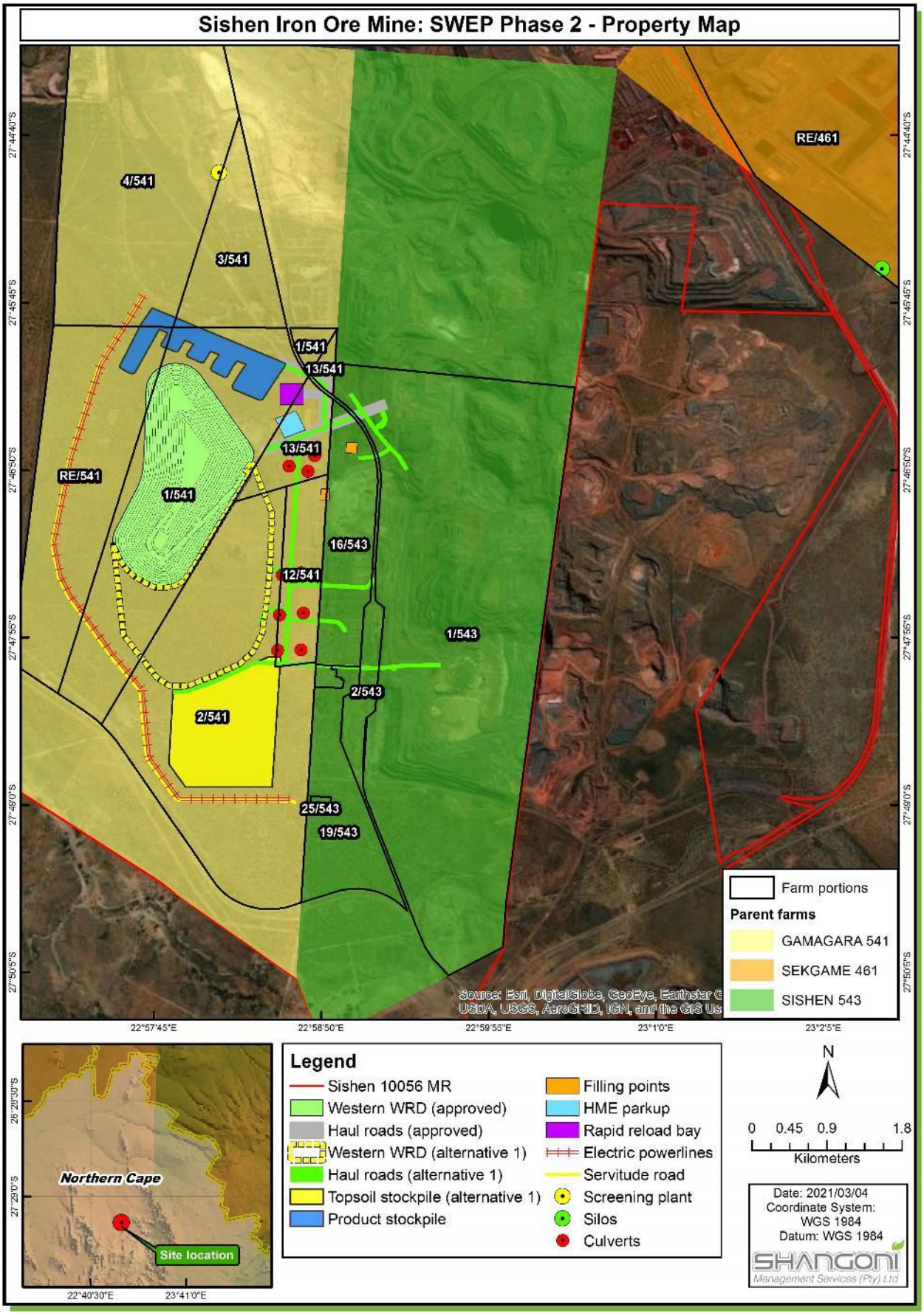

Figure 1: Affected properties associated with the proposed activities (Preferred alternatives reflected as assessed in Section 7.1)

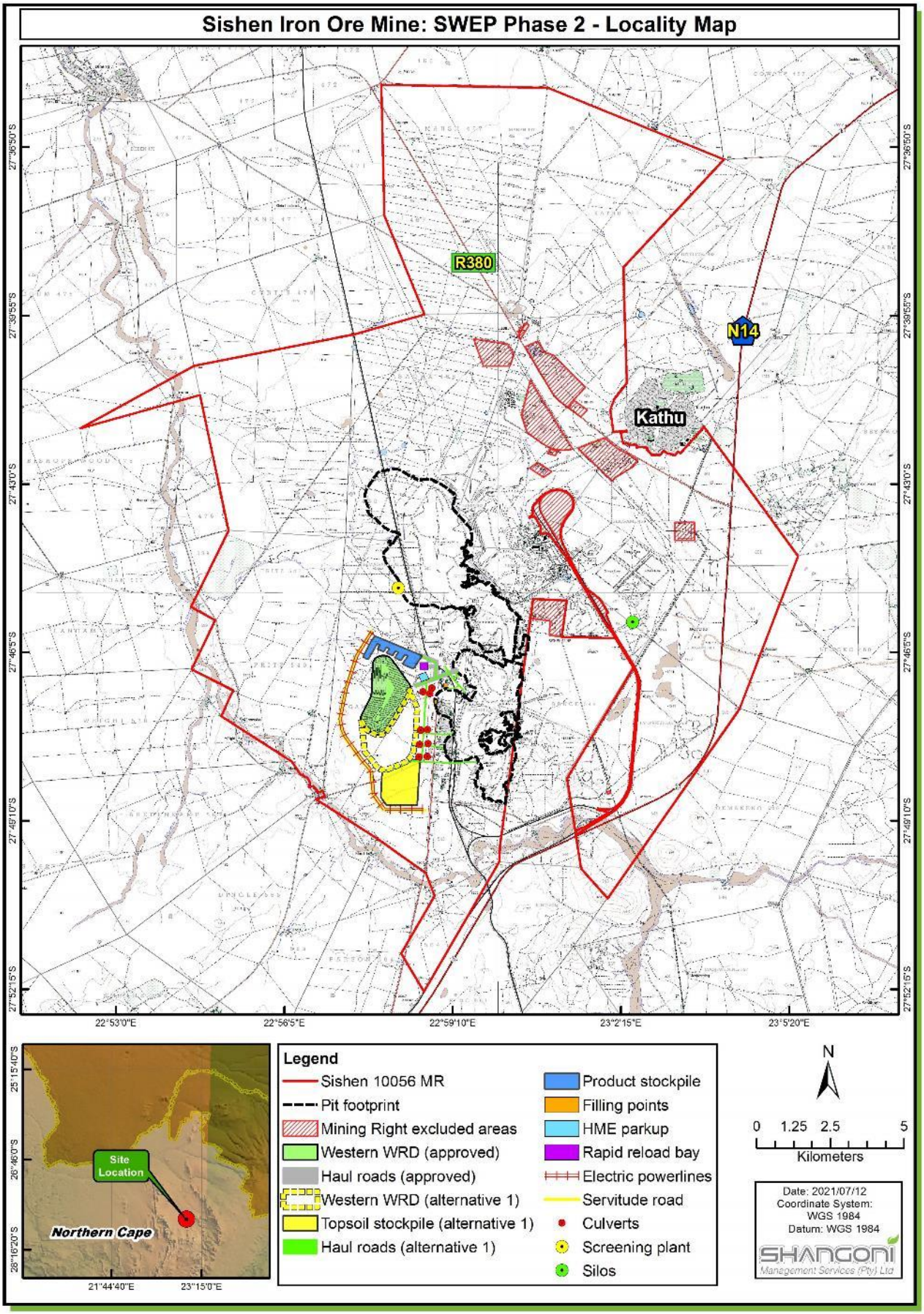

Figure 2: Locality of Sishen Iron Ore Mine

4 Description of the scope of the proposed activities

Sishen Iron Ore Mine (Pty) Ltd ("SIOM") is operating under mining right number NC 5/3/2/106 MRC) and the Sishen Iron Ore Mine Pit and Dump Extension & EMPr Consolidation DMR Reference number: NC 30/5/1/2/2/ (10056) MR approved 28 March 2018.

The Sishen Western Expansion Project ("SWEP") included the relocation of the Transnet railway line, Vaal-Gamagara pipeline and the relocation of the Dingleton town. SIOM is in the process of expanding its mining activities to the western side of the current mining pit area. The second phase of the SWEP involves expanding of the mining activities (hereafter referred to as SWEP Phase 2). The SWEP Phase 2 includes the following proposed facilities. Figure 11 illustrates the location of the proposed infrastructure.

Expansion of the Western Waste Rock Dump 5

West Rock Dump 5 is an additional waste dump that will be constructed in the south mine. The waste dump is part of Push Back 16 and 23 and is critical to the extension of life of mine ("LOM") to 2035. The high urgency of the expansion of Western Waste Rock Dump 5 is due to the lack of available approved space to dump incompetent waste rock material. Incompetent waste volumes increased, as past long-term plans and geological interpretations highly under-estimated the volumes of incompetent waste material from the mining areas. Waste Volumes also increased due to the increased reserve shell thus the increased LOM.

The Western Waste Rock Dump 5 Expansion will cover an area of 250 ha and will reach a height of 120 m. Waste rock from the adjacent pit will be disposed of onto the Western Waste Rock Dump 5 for the remainder of the LOM.

A study conducted by Exigo in 2014 (*Sishen Iron Ore Mine: Western Waste Rock Dumps - Mine Residue Leachate Assessment Geochemical Study,* refer to Annexure E9*)* revealed that the waste rock material generated by the mining activities are non-acid forming. Very little or no sulphur minerals were detected while an abundance of neutralising minerals are present.

The leachate study conducted revealed that no constituents exceeded the lowest regulatory value of Regulation 635. Regarding the total element concentration of the solid phases recorded, SIOM residue material exceeded the lowest threshold value for arsenic (As), barium (Ba), copper (Cu), manganese (Mn) and lead (Pb) and the highest threshold value for fluoride (F). It must be stressed that the exceedances of these elements merely indicate the presence in the solid phase and is highly unlikely that they will leach long-term given the non-acid potentials and alkaline seepage. This was verified in the geochemical modelling exercise conducted by Exigo (2014). They showed that the waste rock dump will leach circum-neutral water with low metal and ion content with a total dissolved solid (TDS) content of 262 mg/l (within ideal domestic standards). According to the geochemical investigation conducted by Exigo, the waste rock material can therefore be regarded as 'inert'.

Limited contamination is expected in the haematite iron ore mining environment. The iron ore and host rock are chemically inert thus preventing acid formation and related water resource contamination. Long-term pollution of the groundwater and surface water from the mine residue facilities are unlikely.

Rapid reload bay will be combined with a Heavy Mining Equipment ("HME") Parkup

A rapid reload bay will be constructed for the temporary storage of high energy fuel during the day (i.e., emulsion) to be used for blasting. The high energy fuel will be stored in five 76 000 ℓ tankers. The emulsion will be pumped from the tanker into the smaller tanker trucks that will transport the emulsion to the blasting area.

A designated area for the rapid reloading of high energy fuel (i.e., emulsion) will be demarcated with fencing and berms. The high energy fuel will be transported to the designated area by 76 000 ℓ tankers and parked. The tankers that service the blasting area will refill at the reloading bay from the 76 000 ℓ tankers. When the 76000 ℓ tankers are empty they will reload at the HEF plant that is the permanent storage facility of the high energy fuel. The emulsion will be used for blasting.

A HME Parkup will be constructed to allow for an area where the mining equipment will be parked when not in use. The HME Parkup design will make allowance for 30 HMEs and include a concreted wash bay, office, chemical toilets, tyre bay, and break test ramp. Diesel will be brought in with diesel bowsers and grease on lube trucks when required for maintenance.

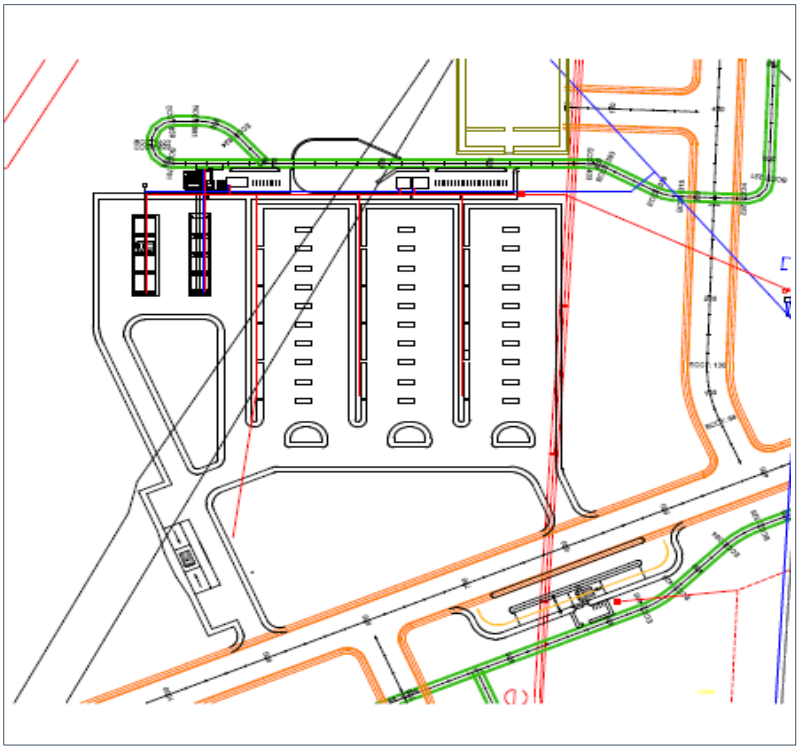

Figure 3: Rapid reload bay

Filling points and water lines

Due to the deployment of Pushback 12 and the subsequent change to the C-Pit Design, the existing Filling Point 11 has been removed and it is necessary to construct a new filling point at an alternative position. The filling point is aimed at providing water to water trucks close to the mining area to increase

the efficiency of dust management. If these filling points are not constructed, the water bowsers in North Mine will need to travel excessive distances to other filling points to obtain water.

Dust management is critical for SIOM operations, and it is critical to have the close availability of water to keep dust levels below the required limit. Two filling points will provide water supply for dust suppression as will be located along the haul road; one to the north and one to the south. Water lines to the filling points will be required for dust suppression of the haul roads.

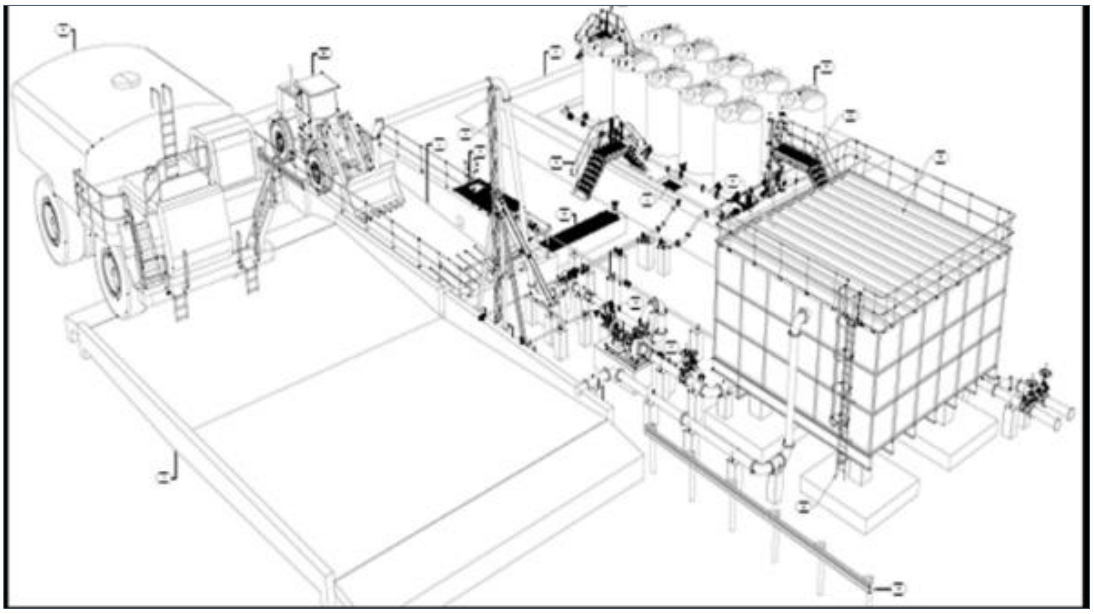

Figure 4: Filling point

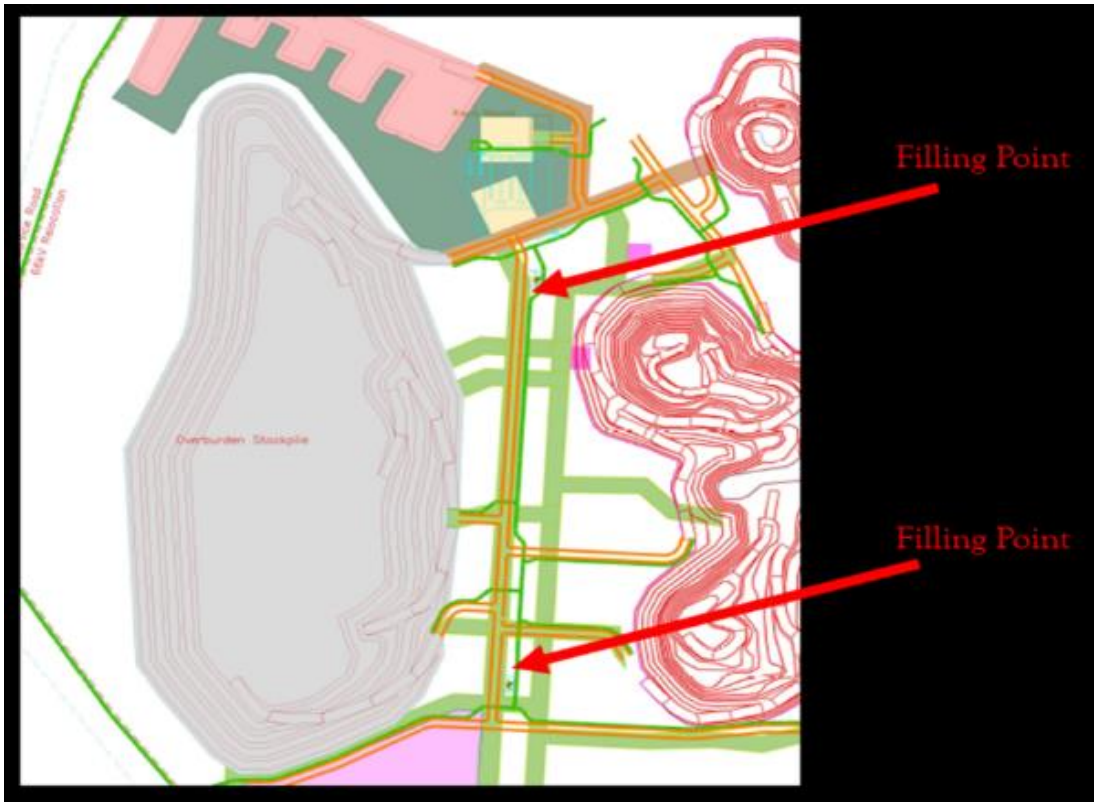

Figure 5: Two fillings points proposed

Weighbridge

The weighbridge will be near the HME Parkup area. The weighbridge will be a single weighbridge with modular equipment allowing it to be moved when required to do so. The weighbridge must make provision for the Komatsu 960 and a load capacity of 600 tonnes.

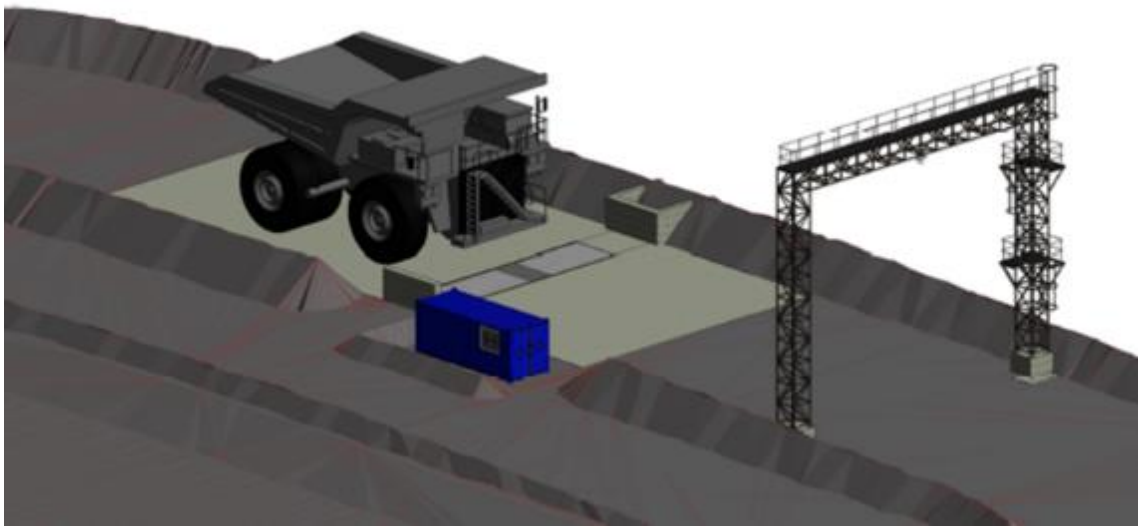

Figure 6: Weighbridge

Topsoil stockpile

The area to the south of the Western Waste Rock Dump 5 will be used for the stockpiling of topsoil stripped from the footprint areas of the proposed facilities. The topsoil stockpile will be 155 ha in extent with 272 270.5m³ material and 20 m in height. The proposed stockpiling area will be located south of the Western Waste Rock Dump 5.

Figure 7: Proposed topsoil stockpile area

Product stockpile

A product stockpile to the north of the Western Waste Rock Dump 5 will be constructed to provide for the stockpiling of C-grade iron ore. The C-grade stockpile will cover an area of 65 ha and will be approximately 20 m high. The product stockpile dump area will require topsoil stripping prior to being established.

Haul roads

Various haul roads will be constructed to provide access to the various proposed facilities.

Fencing on the outside of the servitude road

On the outer boundary of the Western Waste Rock Dump 5 a fence will be erected. On the inside of the fence a servitude road will be constructed. A 2350 mm high security fence with diamond mesh will be erected, with an overhang at the outer limit of the dump as indicated below at a total length of 11.62 km.

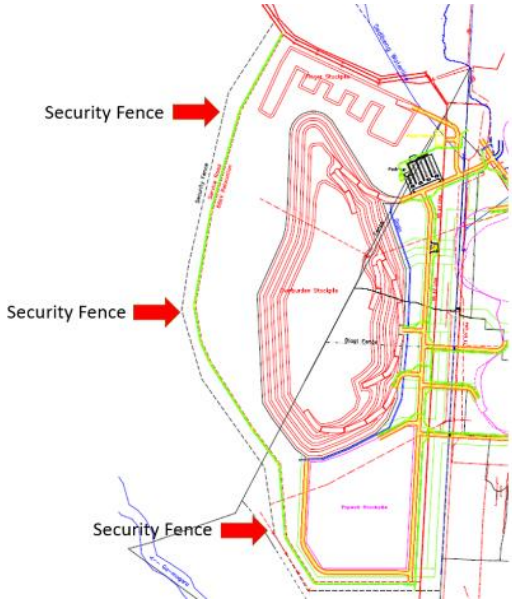

Figure 8: Proposed security fence

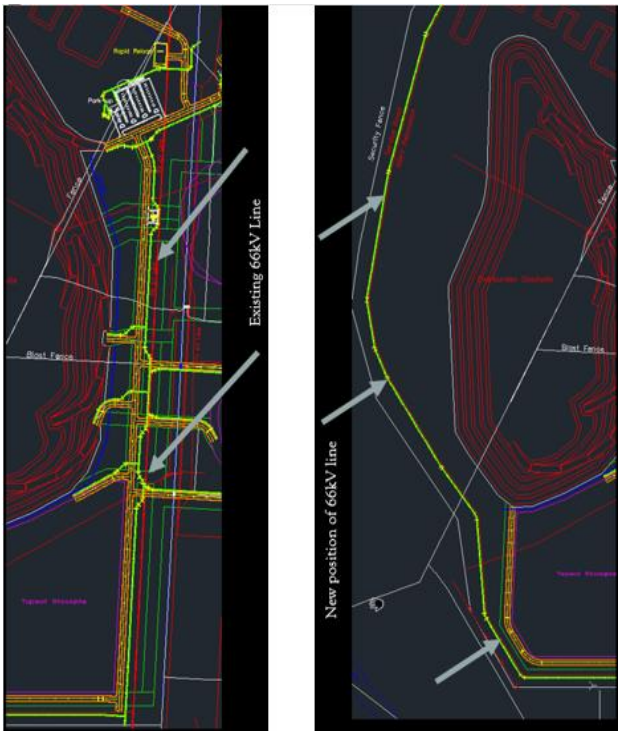

Figure 9: Relocation of the existing 66 kV line to new location

Electric powerlines

The current position of the 66 kV line will be in the way of the haul trucks as the line is too low. The line will be relocated to accommodate the new haul roads. The current line is a single wolf, and the new line must be designed as a single wolf that can accommodate 40 MVA and will be rerouted from the current substation. The length of the line is approximately 7.61 km.

Fibre optic cabling

Project K0248 Sishen Backhaul Fibre Project aims to install a redundant fibre optic cabling ring connecting the fixed access points around the Sishen north and south mines. The route connecting

Mabele, Vliegveld, FAP 5 will be installed in parallel with the intended powerlines to the west of the Dingleton waste dumps.

Screening plant

A screening plant will be constructed to screen plant by-product into 15-20 mm size particles and fines (<14 mm). The 15-20 mm will be loaded and used as stemming for blasting holes and the smaller material will be used for road construction. Approximately 100 000 m^3 of material will be processed at this plant per month.

Silos (Ammonium Nitrate)

Additional silos are required at the BME explosive storage area. The silos will be placed against the fence at the existing stores for the storage of ammonium nitrate. There will be eight silos in total. One silo will have a storage capacity of 100 m^3 and will be able to store 80 tonnes of ammonium nitrate.

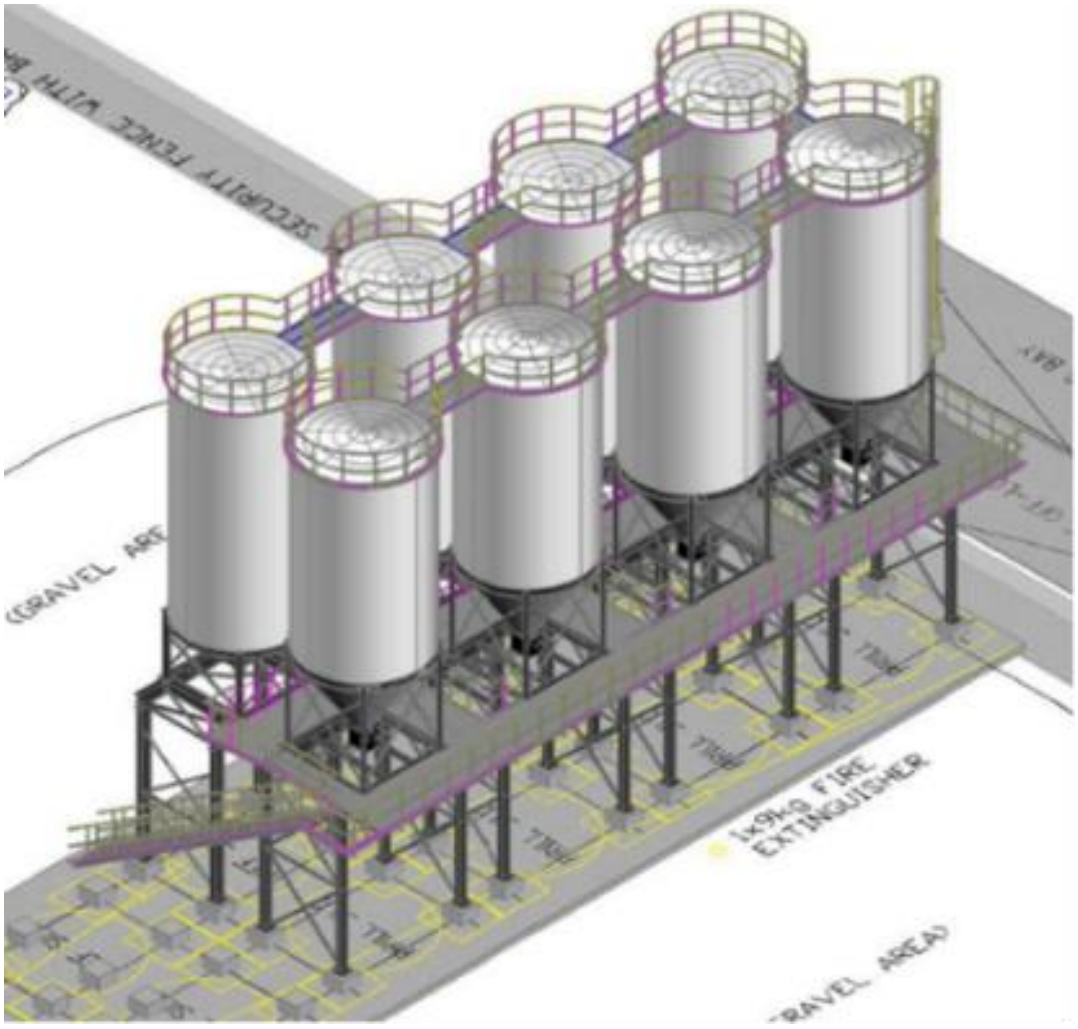

Figure 10: Proposed Silos

Culverts

Cement culverts will be constructed in strategic locations to allow for storm water to drain from the site.

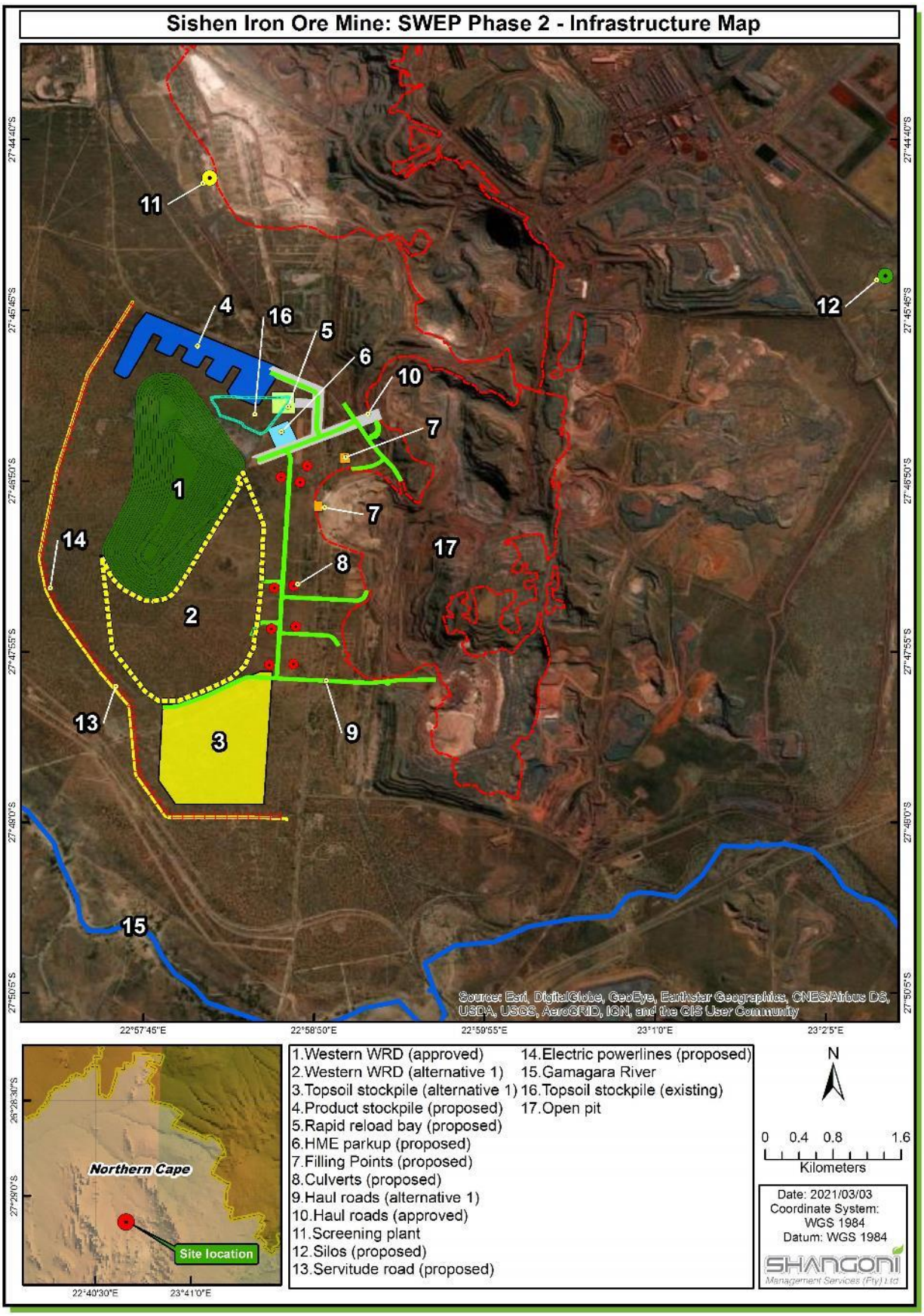

Figure 11: Layout Map of the proposed activities associated with the SWEP Phase 2 (Preferred alternatives reflected as assessed in Section 7.1)

4.1 Listed and specified activities applied for

The SWEP Phase 2 will trigger the following authorisations:

- An Environmental Authorisation ("EA") for listed activities contained in the Environmental Impact Assessment Regulations Listing Notices of 2014, as amended, and published in terms of sections 24(2), 24 (5), 24D, 44 and 47(A) (1) (b) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA").
- Waste Management License ("WML") in terms of section 19 of the National Environmental Management Waste Act (Act No. 59 of 2008) ("NEM:WA") and the List of Waste Management Activities ("GN.R 921") dated 29 November 2013, as amended.
- Water Use Licence ("WUL") in terms of the National Water Act, 1998 (Act 36 of 1998) section 21. The following water activities will be applied for:
    - Section 21(c) of the Act: Impeding or diverting the flow of water in a watercourse and Section 21(i) of the Act: Altering the bed, banks, course or characteristics of a watercourse.
    - Section 21(g) of the Act: Disposing of waste in a manner which may detrimentally impact on a water resource.

For the EA and WML applications, a Scoping and Environmental Impact Assessment ("S&EIR") will be conducted in accordance with the NEMA and the Environmental Impact Assessment Regulations, 2014 (GN R982 of 4 December 2014) ("GN R982"), as amended. Listed activities have been identified and provided in the table below.

Table 3: Activities and listed activities associated with the SWEP Phase 2

Name of Activity	Arial Extent of Activity Ha or m²	Listed/ Waste Activity (Mark with X)	Applicable Listing Notice (GNR 706, GNR 325) and applicable Waste Management Activity (GN 921)
Site clearing of the footprint areas of the facilities			
Expansion of the Western Waste Rock Dump 5	250 ha	X	Activity 15 of Listing Notice 2 (GNR 325 of GG 40772 of 7 April 2017): *The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for—* *(i) the undertaking of a linear activity; or* *(ii)maintenance purposes undertaken in accordance with a maintenance management plan.* Activity 12 of Listing Notice 3 (GNR 706 of GG 41766 of 13 July 2018): *The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.*
HME Parkup and weighbridge	5.6 ha		
Filling points	2.5 ha		
Rapid reload bay	6.3 ha		
Topsoil stockpile	155 ha		
Product stockpile	65 ha		
Haul roads.	220 ha		
Servitude road and fence	25 000 m^2		
Electric powerlines	24 000 m^2		
Culverts.	330 m^2		
Screening plant	22 ha	None identified.	

Name of Activity	Arial Extent of Activity Ha or m²	Listed/ Waste Activity (Mark with X)	Applicable Listing Notice (GNR 706, GNR 325) and applicable Waste Management Activity (GN 921)
Silos	20 ha		
Construction and utilisation of the facilities			
Expansion of the Western Waste Rock Dump 5	250 ha	X	Category A: Activity 13: *The expansion of a waste management activity listed in Category A or B of this Schedule which does not trigger an additional waste management activity in terms of this Schedule.*
HME Parkup and weighbridge	5.6 ha	X	Activity 12 of Listing Notice 1 (GNR 706 of GG 41766 of 13 July 2018): *The development of—* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs—* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.* Activity 14 of Listing Notice 3 (GNR 706 of GG 41766 of 13 July 2018): *The development of—* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.*
Filling points	2.5 ha	None identified.	
Rapid reload bay	6.3 ha	X	Activity 4 of Listing Notice 2 (GNR 325 of GG 40772 of 7 April 2017): *The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.*
Topsoil stockpile	155 ha	None identified	

Name of Activity	Arial Extent of Activity Ha or m²	Listed/ Waste Activity (Mark with X)	Applicable Listing Notice (GNR 706, GNR 325) and applicable Waste Management Activity (GN 921)
Product stockpile	65 ha	X	Activity 12 of Listing Notice 1 (GNR 706 of GG 41766 of 13 July 2018): *The development of—* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.* Activity 19 of Listing Notice 1 (GNR 706 of GG 41766 of 13 July 2018): *The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.* Activity 6 of Listing Notice 2 (GNR 325 of GG 40772 of April 2019): *The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.* Activity 14 of Listing Notice 3 (GNR 706 of GG 41766 of 13 July 2018): *The development of—* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.*
Haul roads	220 ha	X	Activity 12 of Listing Notice 1 (GNR 706 of GG 41766 of 13 July 2018): *The development of—* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs—* *(a) within a watercourse.*

Name of Activity	Arial Extent of Activity Ha or m²	Listed/ Waste Activity (Mark with X)	Applicable Listing Notice (GNR 706, GNR 325) and applicable Waste Management Activity (GN 921)
			(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse. Activity 19 of Listing Notice 1 (GNR 706 of GG 41766 of 13 July 2018): *The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.* Activity 24 of Listing Notice 1 (GNR 706 of GG 41766 of 13 July 2018): *The development of a road—* *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres.* Activity 14 of Listing Notice 3 (GNR 706 of GG 41766 of 13 July 2018): *The development of—* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse.* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.*
Servitude road and fence	25 000 m²	X	Activity 4 of Listing Notice 3 (GNR 706 of GG 41766 dated 13 July 2018: *The development of a road wider than 4 metres with a reserve less than 13,5 metres.*
Electric powerlines	24 000 m²	X	Activity 11 of Listing Notice 1 (GNR 706 of GG 41766 of 13 July 2018): *The development of facilities or infrastructure for the transmission and distribution of electricity—* *(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.*
Culverts.	330 m²	X	Activity 12 of Listing Notice 1 (GNR 706 of GG 41766 of 13 July 2018): *The development of—* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs—*

Name of Activity	Arial Extent of Activity Ha or m²	Listed/ Waste Activity (Mark with X)	Applicable Listing Notice (GNR 706, GNR 325) and applicable Waste Management Activity (GN 921)
			(a) within a watercourse. *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.* Activity 19 of Listing Notice 1 (GNR 706 of GG 41766 of 13 July 2018): *The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.* Activity 14 of Listing Notice 3 (GNR 706 of GG 41766 of 13 July 2018): *The development of—* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse.* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.*
Screening plant	22 ha	X	Activity 17 of Listing Notice 2 (GNR 325 of GG 40772 of 7 April 2017): *Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including—* *(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing.*
Silos	20 ha	X	Activity 4 of Listing Notice 2 (GNR 325 of GG 40772 of 7 April 2017): *The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.*

4.2 Description of existing authorised mining activities

4.2.1 Life of Mine Planning

The life-of-mine planning process at SIOM entails 7 stages as illustrated in the figure below.

The life-of-mine planning process can take up to two years to complete. This means that at any given time more than one product strategy and/or waste stripping strategy can be in the process of being investigated.

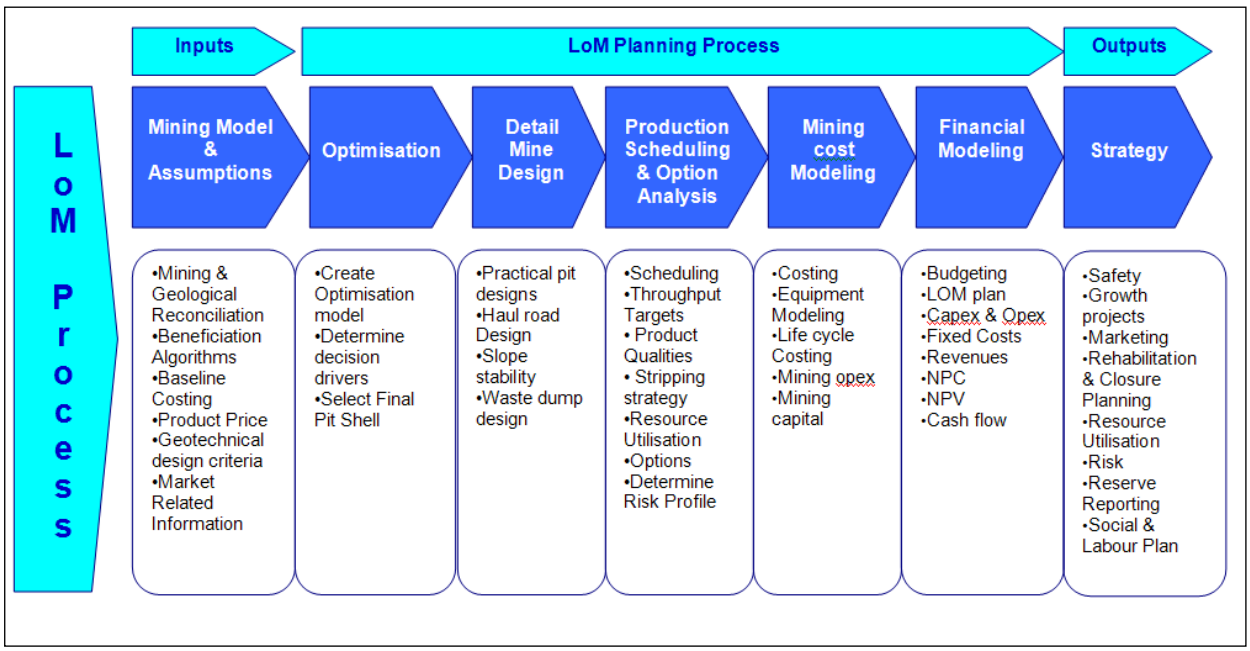

Figure 12: Life-of-Mine Planning Process

The life-of-mine planning process results in a final strategic decision regarding the life of the operation. This leads to the development of a life-of-operation schedule showing in detail all infrastructure developments and a specific product strategy.

Geological Description

The Superior-type banded iron-formations (BIFs) of the Transvaal Supergroup lithologies were deposited in two related basins, one in an extensive continental shelf environment and the other in an intra-continental sea, both situated on the Kaapvaal craton.

The basin, preserved along the western margin of the Kaapvaal craton, is referred to as the Griqualand west basin and hosts the largest known resources of high-grade hematite ore on the Southern African part of the continent. In the Postmasburg-Sishen sub-region, iron ore and associated lithologies of the Transvaal (locally termed Griqualand West Sequence) and Olifantshoek Supergroups crop out intermittently along a 60 km arcuate belt. The iron ore outcrops define an important regional anticlinal structure known as the Maremane Dome.

At SIOM, high-grade hematite ore is extracted from the Transvaal and Olifantshoek Supergroups. The SIOM is located at the northern end of the Maremane anticline, with the Beeshoek Mine and the new

Kolomela Mine, at the southern end. At this locality, the bulk of the hematite ore is buried beneath younger cover lithologies. The buried lithology's strike north south and plunge off the anticline in a northerly direction.

Mineral mined

The mineral mined is Iron Ore (Commodity Codes: Fe; Mineral Type: B).

Mining Horizons

The ores at SIOM are composed of hematite and specular hematite with minor to trace amounts of hydrated iron oxide (limonite). Four distinct ore types can be classified in the table below.

Table 4: Typical In-Situ Grades per Ore Type

ORE TYPE	%	Fe	SiO_2	Al_2O_3	K_2O	P
Conglomeratic and grit	18	62.16	5.34	2.87	0.279	0.055
Breccia	8	63.39	3.91	1.98	0.388	0.078
Massive	20	65.16	2.99	1.35	0.136	0.044
Laminated	54	66.27	2.39	0.834	0.074	0.056

Each has unique chemical, physical and metallurgical properties. The genesis of each ore type has been influenced by regional tectonism and the preservation of each ore body is primarily determined by local geological structures.

The relative proportion of ore types also have a significant operational and financial impact. The large proportion of lower-grade breccia ore and some of the conglomerate ores at Sishen requires considerable blending to optimize utilisation of the resource.

Quartzite

The clastic sequence of the Gamagara Subgroup contains a prominent light-cream to dark-purple coloured quartzite, termed the Marthaspoort Formation. The quartzite unit can be up to 40 m thick. The colour of the quartzite varies in conjunction with iron impurities within the matrix of the well- rounded silica grains. The light-cream coloured quartzite has a quartz-rich matrix, is fine-grained and has a massive texture. It is this light-cream coloured quartzite that is sought for crushing material.

In the process of mining iron ore waste needs to be stripped. Some of the waste stripped is quartzite and is stockpiled for a BEE contractor. The contractor produces different products, aggregates, and ballast from the quartzite. The production rate of these products varies according to contracts to supply these products to different clients. SIOM, Kolomela mine and Transnet are the main clients for ballast and aggregate.

Size of deposit

The hematite ore bodies of SIOM outcrop near and along the eastern boundary of the farm Sishen and extend westwards down dip to a depth of 600 m and more. The regional dip is about 11º to the west. Local variations in the direction and magnitude, due to folding, refolding, and faulting (thrusting in some

areas) are common. Consequently, domes and depressions including anticlines and synclines are present locally (Mining Works Programme, 2016).

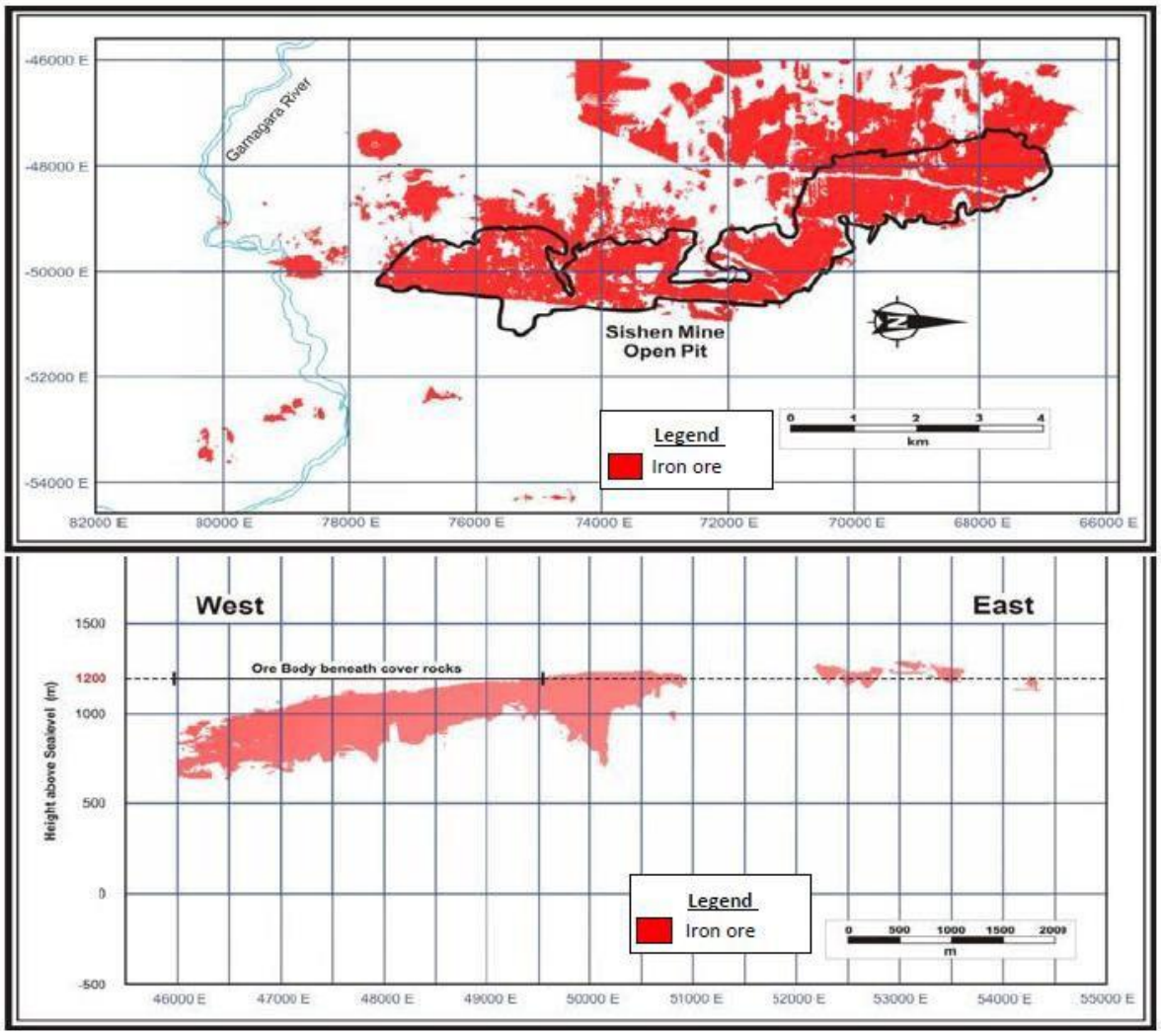

Figure 13: Plan Extent of current Known Hematite Mineralization

4.2.2. Mining methods

Mining is conventional truck and shovel opencast operations and involves topsoil stripping and stockpiling, blast hole drilling, blasting, dozing and excavation, shovelling and loading of material, haulage of run of mine ("ROM") ore from the mine pit to the crushing plants, and haulage of waste material to the mining waste deposits or back into mined out areas of the mine as part of backfilling of the mine pit. Equipment used in and around the mine pit includes drill rigs, shovels, bulldozers, road graders, front-end loaders, large haul trucks and various ancillary equipment, including water tankers, road sweepers and vehicles used for application of chemical dust suppressants to haul roads.

Mining started in outcrop and shallow ore areas along the north to south strike of the ore body and is generally progressing in a westerly direction along the dip of the ore body, with the mine pit becoming increasingly deeper towards the west.

The haematite ore occurs in beds of varying thickness and grades and interbedded impurities occur in bands in the laminated ores. Blending of ore is necessitated by this complex geology and the fact that

the DMS plant does not have the capability to blend different ore grades. Ongoing in-pit blending is needed to ensure that the correct product specifications are continuously achieved.

The haematite ore has a high specific gravity and is very hard and mining is therefore considered 'heavy'. Only a small proportion of the waste rock (overburden) can be free dug and most of the rock (> 75%) requires drilling and blasting. Four types of hard iron ore, namely massive, laminated, conglomerated, and brecciate iron ore are mined. Blast hole drilling is a continuous process and blasting is done once a day, typically in the early afternoons between 12h00 and 14h00, at each of the active mining areas within the mine pit.

Blasting work near buildings and surface infrastructure occurs in terms of formal permissions obtained from the Principal Inspector of Mines, Mine Health and Safety and in accordance with conditions agreed to by SIOM and the relevant stakeholders and affected parties.

The clastic sequence of the Gamagara Subgroup contains a prominent light-cream to dark-purple coloured quartzite, termed the Marthaspoort Formation. The quartzite unit can be up to 40 m thick. The colour of the quartzite varies in conjunction with iron impurities within the matrix of the well- rounded silica grains. The light-cream coloured quartzite has a quartz-rich matrix, is fine-grained and has a massive texture. It is this light-cream coloured quartzite that is sought for crushing material.

Quartzite is crushed in various sizes for e.g., railway foundation ballast or crushed stone for mixing into building cement to produce various strength concrete bases.

4.2.3 Production rates

A high-level map indicating the basic mine design and schematic mining schedule is shown in the table below provides more detail on the schematic schedule for the different mining periods and associated tonnes.

Table 5: Estimated tonnes per period as per proposed mining schedule

Planned Period	RoM Ore (Mt)	Waste (Mt)
2016 - 2019	**146**	**563**
2020 - 2023	**147**	**600**
2024 - 2027	**147**	**567**
2028 - 2032	**118**	**276**
Total	**558**	**2006**

4.2.4 Planned Life of Mine

The remaining life of mine is currently estimated to be at least until 2035. The life of mine is a function of the defined mineral reserve and production rates, world iron ore market, and advancements in technologies to process lower grade ore, which could extend the life of mine. SIOM is thus projected to be a long life mine.

5 Policy and legislative context

The following table is a summary of the policy and legislative context applicable to the proposed SWEP Phase 2.

Table 6: Policy and legislative context

Applicable Legislation and Guidelines used to compile the Report	Compliance and response of the SWEP Phase 2
The Constitution of the Republic of South Africa, 1996.	The Constitution of the Republic of South Africa was considered and applied to throughout the Environmental Management Programme report ("EIAR/EMPr") as the Constitution states that everyone has the right: (a) To an environment that is not harmful to their health or well-being; and (b) To have the environment protected, for the benefit of present and future generations.
The Mineral and Petroleum Resources Development Act (Act No. 28 of 2002, as amended).	The EIAR/EMPr has been compiled to comply to the requirements of the Mineral and Petroleum Resources Development Regulations (GN R527 dated 2004).
The National Environmental Management Act (Act No. 107 of 1998 as amended).	The EIAR/EMPr has been compiled in terms of GN R982, as amended and promulgated in terms of sections 24(5), 24M and 44 of the National Environmental Management Act, Act No. 107 of 1998 ("NEMA").
The Environmental Impact Assessment Regulations (GN R982 dated 2014, as amended).	The EIAR/EMPr was compiled in terms of the requirements of Appendix 2 of the Environmental Impact Assessment ("EIA") Regulations (GN R.982 dated 2014, as amended).
The Environmental Impact Assessment Regulation. Listing Notice 1. (GNR 706 GG41766 published 13 July 2018)	Activity 11, 12, 19 and 24 of Listing Notice 1 are applied for as part of the SWEP Phase 2.
The Environmental Impact Assessment Regulation. Listing Notice 2. (GNR 325 GG 40772 published 7 April 2017)	Activity 4, 6 and 17 of Listing Notice 2 are applied for as part of the SWEP Phase 2.
The Environmental Impact Assessment Regulation. Listing Notice 3. (GNR 706 GG 41766 published 13 July 2018)	Activity 12 and 14 of Listing Notice 3 are applied for as part of the SWEP Phase 2.
Integrated Environmental Management Guideline: Guideline on Need and Desirability (2017).	The need and desirability were assessed for the SWEP Phase 2.
Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector.	Biodiversity related to the SWEP Phase 2 was considered when sites were selected, and alternatives considered.
The National Water Act (Act No. 36 of 1998, as amended).	The SWEP Phase 2 will require a water use license ("WUL") for the following: • Section 21 (c) and (i) for the Western Waste Rock Dump Expansion, HME Parkup, Filling points, rapid reload bay, topsoil stockpile, product stockpile, haul roads, servitude road, electric powerlines and culverts. • Section 21(g) for the Western Waste Rock Dump Expansion. The WUL will be applied for separately.
Regulations on use of water for mining and related activities aimed at the protection of water resources published in terms of the National Water Act under Government Notice 704 of 4 June 1999 (GN R704).	Storm water management measures, in compliance to GN R704, will be implemented at the SWEP Phase 2.

Applicable Legislation and Guidelines used to compile the Report	Compliance and response of the SWEP Phase 2
The National Environmental Management: Biodiversity (Act 10 of 2004, as amended).	Biodiversity related to the SWEP Phase 2 and the alternatives considered. DENC permits in terms of National Environmental Management: Biodiversity (Act 10 of 2004, as amended) will be required for the SWEP Phase 2 for the removal of nationally protected trees (*Vachellia erioloba* and *Boscia albitrunca*).
Alien and Invasive Species Regulations (GN R598 dated 2014).	The occurrence of alien and invasive species will be assessed and mitigated (in accordance with these regulations) during the operational phase of the SWEP Phase 2.
Conservation of Agricultural Resources (Act 43 of 1983).	Erosion potential will be assessed and mitigated (in accordance with this act) during the operational phase of the SWEP Phase 2.
The National Environmental Management: Air Quality (Act 39 of 2004, as amended).	No Atmospheric Emissions Licence is required for the SWEP Phase 2.
SABS Code of Practice 0103 of 2008: The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication. SABS Code of Practice 0328 of 2008: Environmental Noise Impact Assessments.	The SABS Code of Practice 0103 will be taken into account when the mitigation measures for the SWEP Phase 2 are identified.
National Environmental Management: Waste Act (Act No. 59 of 2008, as amended).	The expansion of the Western Waste Rock Dump 5 is applied for as part of the SWEP Phase 2. The activity applied for in terms of NEM:WA, 2008 - GN 921 includes Activity 13 in Category A:
National Heritage Resources Act (Act No. 25 of 1999, as amended).	No archaeological or historical sites are affected by and in close proximity to the areas where the SWEP Phase 2 will be taking place.
DMRE Guideline for Consultation with communities and Interested and Affected Parties. As required in terms of sections 16(4)(b) or 27(5)(b) of the MPRDA, and in accordance with the standard directive for the compilation thereof as published on the official website of the Department of Mineral Resources.	The public participation process is done in accordance with the DMRE guideline for consultation with communities and interested and affected parties.
Integrated Environmental Management Information Series. Criteria for determining alternatives in EIA.	Alternatives were assessed for the SWEP Phase 2 in section 7.1 of this EIAR/EMPr.

6 Need and desirability of the proposed activities

6.1 Need and desirability in terms of the guideline on need and desirability, 2017

In 2017, the then Department of Environmental Affairs published an Integrated Environmental Management Guideline, the Guideline on Need and Desirability. The following provides information on how the guideline requirements were considered in this EIAR/EMPr.

6.1.1 How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?[1]

- The ecological integrity of the area was assessed as part of the specialist assessments (biodiversity and wetland impact assessments) with the baseline environmental description provided in Section 7.4.1 below. Impacts that have been identified resulting from SWEP Phase have been discussed in Section 7.5 of this document.
- Alternatives have been identified to limit the impact to natural resources. Refer to section 7.1. for the alternatives identified and section 7.7 for the advantages and disadvantages of the alternatives identified.
- The proposed SWEP Phase 2, with specific refence to the risk of reserve sterilisation from the waste rock dump location, has considered location to minimise such risks and avoid loss of natural resource.
- The impacts on non-renewable resources that have been identified resulting from SWEP Phase 2 have been discussed in Section 7.5.1 of this document. Further thereto, a separate WUL application will be submitted for the SWEP Phase 2.
- The *Sishen Western Expansion Project: Phase 2 - Storm Water Management Plan* compiled by Shangoni Management Services (Pty) Ltd dated April 2021 proposed measures that will ensure clean and dirty water separation to meet the requirements in accordance with the best practice guidelines (DWAF, 2006), Section 19 of the National Water Act and Regulation GN 704 (No. 704 of 4 June 1999) in terms of the National Water Act (Act No. 36 of 1998).
- SWEP Phase 2 will not impact any cultural heritage of the area. Refer to section 7.4.1, and Chapter K. According to the *1st phase H.I.A. of a proposed extension and upgrading at Sishen Mine, also known as phase two of the Sishen Western Expansion Project that is located on portions of Gamagara and Doornvlei, Northern Cape,* compiled by Sidney Miller dated November 2020. There will be no impacts from SWEP Phase 2 on the stone, iron age and historical sites or material.
- The preferred alternatives in Section 7 (alternatives 1 for waste rock dump, and haul road) will reduce the loss of habitat and will not impact on the pans (SSW01 and SSNF05).
- SWEP Phase 2 will allow continuation of mining activities. SWEP Phase 2, therefore, ensures that those who are already employed remain employed.
- Knowledge gaps as well as relevant assumptions were identified in section 14 of Part A of this EIAR/EMPr.
- All negative and positive impacts associated with SWEP Phase 2 have been identified by the specialists and discussed in Section 7.5 below.

[1] Section 24 of the Constitution and section 2(4)(a)(vi) of NEMA refer.

6.1.2 Promoting justifiable economic and social development[2]

- The proposed SWEP will allow continuation of mining activities and ensure security of the Life of Mine (to the year 2035) of SIOM and will not lead to sterilisation of ore.
- The local economy is largely dependent on the mining sector. The proposed SWEP Phase 2 will continue to contribute to the socio economy in the area as mining of iron ore can continue.
- A Social and Labour Plan ("SLP") has been developed and implemented for SIOM.
- The needs of the community will be determined through the public participation process of this EIAR/EMPr with the results of the public participation process presented in the Public Participation Report. The public participation process that has been conducted aims to ensure that all I&APs are provided with an opportunity of access to information regarding the SWEP Phase 2 and to raise any concerns or provide any comments on the SWEP Phase 2.
- SIOM will ensure that the financial liability associated with the rehabilitation of the proposed activities of the SWEP Phase 2 is provided for as part the closure liability of SIOM. Refer to Section 18 of Part A.

7 Motivation for the preferred development footprint within the approved site

7.1 Details of alternatives considered as part of the proposed project

The following alternatives have been identified as part of the SWEP Phase 2 and are assessed in the EIAR/EMPr.

7.1.1 Location alternatives

Waste rock dump:

Alternative 1 is to the south of the approved waste rock dump. Alternative 2 is similar in location, but with further extension in a westerly direction. Refer to Figure 14.

Haul roads:

Alternative 1 is a single haul road with on and offramps into the pit and waste rock dump area. Alternative 2 is a dual haul road with on and offramps into the pit and waste rock dump area. Refer to Figure 14.

[2] Section 24 of the Constitution refers.

7.1.2 Alternatives for waste rock disposal

Waste rock dump:

Alternatives 1 and 2 is an expansion of the approved waste rock dump (*Environmental authorisation for the Western waste rock dump expansion, 2014*).

In pit dumping:

Alternative 3 is in-pit-dumping whereby the waste rock is directly tipped into mined-out areas of the north mine pit. This is however not feasible as mining will continue in north and south mine for the next 5 years prohibiting waste rock disposal.

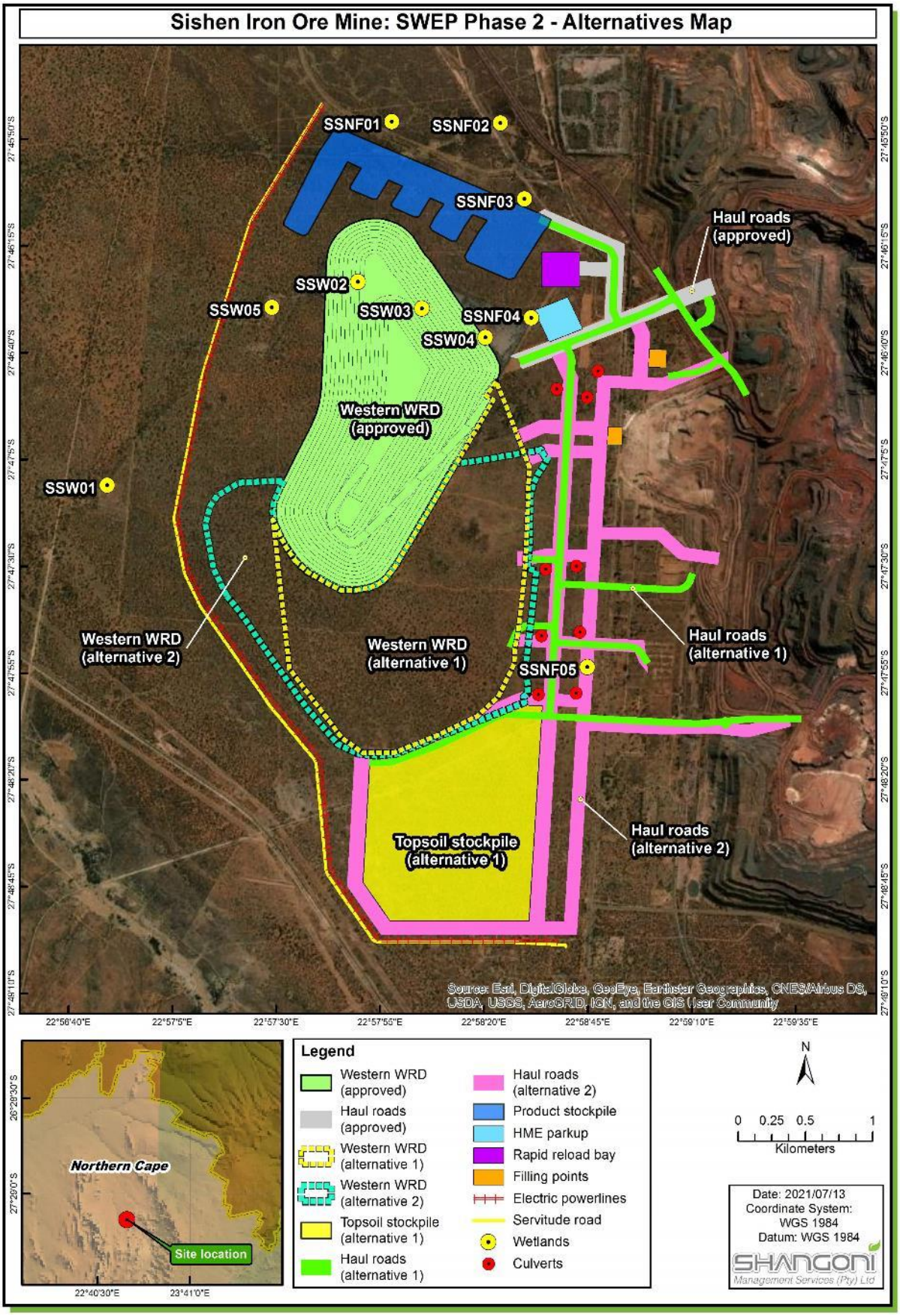

Figure 14: Alternatives considered

7.1.3 No alternatives assessed

Topsoil stockpile:

There is only one alternative that is alternative 1 for a topsoil stockpiling area. An investigation into location alternatives was undertaken and proved to be unviable as the pans (SSW01 and SSNF05) that are deemed sensitive would be impacted upon. An additional problem is the insufficient space for an alternative topsoil stockpile area. Concurrent rehabilitation is considered (to avoid topsoil storage) but currently the mine has limited areas that require topsoil and the need for a topsoil stockpile is critical.

7.1.4 No-go option

The no-go option would mean that the status quo of the environment (biodiversity - as no clearance of vegetation will take place) would remain and there would be no additional impacts to the site. However, if the proposed extension of the waste rock dump is not continued with, the mine would run out of storage capacity, which will prevent continuation of mining.

7.2 Details of the Public Participation Process followed

The public participation process was conducted by Shangoni Management Services (Pty) Ltd in terms of:

- The procedures and provisions in terms of the NEMA,
- Chapter 6 of the 2014 EIA Regulations,
- GN 807 of 2012; Public Participation Guideline, and
- Other relevant legislation such as the Promotion of Access to Information Act (PAIA), 2000.

7.2.1 Identification and registration of I&APs and key stakeholders

The below lists the landowners, adjacent landowners and organs of state identified and notified (by means of e-mail, telephone, fax and/or post) of the SIOM. All organs of state that may have jurisdiction in respect of the proposed project is considered to be registered I&APs. The following groups of interested and affected parties were identified: For a detailed list refer to Annexure D.

- Forum farmers;
- Eskom;
- Transnet;
- Gatelopele Investments & Mining Cc;
- M & S Consulting;
- Ditukus Projects (Pty) Ltd;
- Ndi Geological Consulting Services;
- Northern Cape: Department of Water & Sanitation;
- Northern Cape: Department of Agriculture, Forestry & Fisheries;
- Northern Cape: Department of Mineral Resources;
- Department Of Social Development;

- Department Of Environment and Nature Conservation;
- SAHRA;
- Northern Cape: Department of Agriculture, Forestry & Fisheries;
- Chief Director: Land Restitution Support;
- Gamagara Local Municipality Ward 1; and
- John Taolo Gaetsewe District Municipality.

7.2.2 Methods of notification

7.2.2.1 Scoping phase

A detailed public participation process was undertaken as part of the initial application - and scoping phase for the SWEP Phase 2. The following has been conducted as part of the Environmental Authorisation Application (proof hereof is included in the Public Participation Report attached as Annexure D to this report):

- Advertisements.
    - A Newspaper advertisement was placed in the Kathu Gazette on 30 April 2021.
- Site notices.
    - Five (5) site notices were placed at the Kathu Foodzone, Public Library, Police Station, Super Spar, and the Sishen Permit office.
- Written notices.
    - Written notices (including Background Information Documents) were distributed to Interested and Affected Parties (“I&APs”).
- Availability of Scoping Report for public review
    - The draft Scoping Report (“DSR”) was made available for public and stakeholder review for a period of 30 days (from 30 April to 30 May 2021). Hard copies of the mentioned document were made available at the Sishen Auditorium and the Kathu Library. An electronic copy of the DSR was posted on the Shangoni’s website.
    - Notices providing the detail of the public viewing station and review period, were sent to registered I&APs via e-mail. This notification also formed part of the above-mentioned advertisement and site notices.

7.2.1.1 EIAR/EMPr phase

Advertisement(s)

The proposed project will be advertised in the Kathu Gazette on the 3 of September 2021. The Kathu Gazette was found to be the most appropriate newspaper in terms of its accessibility to the I&APs. A copy of the advertisement is attached hereto in Annexure D public participation report.

7.2.1.2 Placement of site- and public notices

Notice was also given to Interested and Affected Parties ("I&APs") by notice boards. Notice boards were placed at different, noticeable and conspicuous places on the 3 September 2021. A copy of the site notice is attached and placement of site notices in Annexure D.

7.2.1.3 Background Information Document

The Background Information Document ("BID") developed for the proposed project provides background information pertaining to the project and is intended to inform I&APs of the proposed project. The BID also includes a registration form that I&APs, stakeholders and organs of state are encouraged to complete in order to register as an I&AP for the proposed project. The BID was made available on the 3 September 2021 to all landowners within and surrounding the mine as well as to all organs of state that may have jurisdiction over any aspect of the activity. The BID will also be made available to any other person who becomes involved in the on-going Public Participation Process ("PPP"). A copy of the BID and proof of notification to I&APs is attached hereto in Annexure D.

7.2.1.4 I&APs register

Once all landowners, adjacent landowners, organs of state and the public are notified of the proposed project, an I&APs register is kept and will be updated during the process. Refer to **Error! Reference source not found.** for a list of organs of states, stakeholders and landowners notified. A copy of details may be provided upon request.

7.2.1.5 Access and opportunity to comment on written submissions

The draft EIAR/EMPr was made available to the public for review for a period of thirty (30) days, from 3 September to 3 October 2021. A copy of the mentioned document was made available on the Shangoni's website (www. shangoni.co.za) for the I&APs to view. All the registered I&APs were notified of the availability of the EIAR/EMPr for public review by 3 September 2021.

Comments and registration forms, as well as Shangoni's response to the comments are attached in Annexure D.

7.2.3 Consultation with the relevant Authorities

7.2.3.1 Application form in terms of the NEMA

The application for environmental authorisation was submitted to the DMRE, via SAMRAD, and a hard copy was submitted on 30 April 2021. A copy of the application for environmental authorisation form is attached hereto in Annexure C1. A copy of DMRE's acknowledgement of receipt letter of the Scoping Report is also attached as Annexure C2.

7.2.3.2 Further consultation with relevant Authorities

Further consultation will be done with the DMRE during the EIA phase.

7.3 Summary of issues raised by I&APs

The table below shows a summary of the comments and issues raised and responses thereto.

Table 7: Summary of the issues raised by the I&APs

Interested and Affected Parties	Date Comments Received	Issues Raised	EAPs Response to Issues as Mandated by the Applicant	Section and Paragraph Reference in this Report Where the Issues and or Responses were Incorporated.
ML Moalahi	5 May 2021	Good day, I hereby request to register as an interested party in Sishen Iron Ore mine for the new expansion and other related developments. Feel free to update me with any developments which are taking place at Sishen Iron Ore, especially the environmental point of view in the mine.	We hereby acknowledge receipt of your email and will register you as an interested and affected party.	Included in the public participation report attached as Annexure D.
Natasha Higgitt (SAHRA)	14 May 2021	Interim Comment The SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit notes the pending assessment of the impact to heritage resources and requests that the assessment comply with section 38(3) of the National Heritage Resources Act, Act 25 of 1999 (NHRA). Additionally, the assessment of the impact to archaeological resources must be conducted by a qualified archaeologist and comply with the 2007 SAHRA Minimum Standards: Archaeological and Palaeontological Components of Impact Assessments. As the prospecting rights application area is located in an area of moderate and high sensitivity for palaeontological resources as per the SAHRIS Palaeo Sensitivity map, a desktop Palaeontological Impact Assessment (PIA) must be required to be undertaken by a qualified palaeontologist. (See https://www.palaeosa.org/heritage-practitioners.html for a list of qualified palaeontologists). The report must comply with the 2012 Minimum Standards: Palaeontological Components of Heritage Impact Assessments. Further comments will be issued upon receipt of the above requested reports and the draft EIA documents inclusive of appendices. Should you have any further queries, please contact the designated official using the case number quoted above in the case header.	We hereby acknowledge receipt of your letter loaded onto SAHRIS. This is not a prospecting rights application but a new project on an existing mining rights area. We take note of your requirement for the heritage study to comply with section 38(3) of the National Heritage Resources Act, Act 25 of 1999. We further take note of your request for a Palaeontological Impact Assessment and have appointed a Palaeontologist to conduct a desktop study for the waste rock dump expansion area.	Included in the public participation report attached as Annexure D.
Alfred Markram	28 May 2021	We are concerned about the dust and noise and people are still staying here. What is the mine going to do?	Good day Alfred, We hereby acknowledge receipt of your comments. Your comments are noted and will be dealt with in the EIA phase.	Included in the public participation report attached as Annexure D.
Department of Mineral Resources and Energy	10 August 2021	The Scoping Report (SR) and Plan of Study for Environmental Impact Assessment received by this Department on the 03rd of August 2021 refers. 1. The Department has evaluated the submitted SR and Plan of Study for Environmental Impact Assessment and is satisfied that the documents comply with the minimum requirements of Appendix 2(2) of National Environmental Management Act, 1998 (as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014.	1. Noted.	1. Not applicable.

Interested and Affected Parties	Date Comments Received	Issues Raised	EAPs Response to Issues as Mandated by the Applicant	Section and Paragraph Reference in this Report Where the Issues and or Responses were Incorporated.
		2. The SR is hereby accepted by the Department in terms of regulation 22(a) of the NEMA EIA Regulations, 2014.	2. Noted.	2. Not applicable.
		3. You may proceed with the environmental impact assessment process on conditions that the below issues are addresses and aligned with the Plan of Study for Environmental Impact Assessment as required in terms of the NEMA EIA Regulations, 2014 as amended: a) Provide the correct GNR numbers for the EIA listed activities. b) A comprehensive assessment of alternatives including backfilling or dump creation in the pits as an alternative. c) Details of the approved activities in the Environmental Management Plan (EMP) [Environmental Authorisation (EA) approved on the 17th of October 2002 versus the activities applied activities. Please make reference of pages to the EMP/EA. d) Provide the approved closure plan and closure objectives as per the EMP/EA approved on the 17th of October 2002. e) Provide a detailed assessment of cumulative impacts. f) Provide specialist studies as contemplated under the plan of study and any other relevant specialist study identified in the process.	3. Noted. a) GNR numbers were updated in the report. b) A comprehensive assessment of alternatives including backfilling or dump creation was conducted. c) The EIAR/EMPr (2017) is the latest approved report and replaces the EMPr (2002). The SWEP Phase 2 project is not an amendment application as new listed activities are applied for. d) The 2002 closure objectives were included. e) Cumulative impacts were provided by the relevant specialist studies. f) Specialist studies were conducted as part of the EIA phase.	3. Noted. a) Refer to section 4.1 in Part A. b) Section 7.1 and 7.8 of Part A. c) Not applicable. d) Refer to section 1.5.2 of Part B table 20. e) Refer to section 7.5.1 in Part A. f) Refer to attached annexure E 1-9.
		4. Please ensure that comments from all relevant stakeholders are submitted to the Department with the Environmental Impact Assessment Report (EIAR). This includes but is not limited to the Provincial Heritage Resources Authority and/or South African Heritage Resources Agency, Provincial Environmental Department, Department of Agriculture, Forestry and Fisheries (DAFF), Department of Water and Sanitation (DWS) and the local municipality. Proof of correspondence with the various stakeholders must be included in the EIAR. Should you be unable to obtain comments, proof of the attempts that were made to obtain comments should be submitted to the Department;	4. Noted. All comments from relevant stakeholders are included in the public participation report.	4. Refer to annexure D.
		5. The applicant is hereby reminded to comply with the requirements of regulation 3 of the NEMA EIA Regulations, 2014 with regards to the time period allowed for complying with the requirements of the Regulations.	5. The timeframes are noted.	5. Not applicable.
		6. Please ensure that the EIAR includes the A3 size locality maps of the area and illustrates the exact location of the proposed development. The maps must be of acceptable quality and as a minimum, have the following attributes: • Maps relatable to one another; • The flood line must be delineated on the topographical map • Co-ordinates; • Legible legends; • Scale of 1 :50000;	6. All maps are attached as annexures are A3 in size.	6. Refer to figure 22 and annexure A for A3 size maps.

Interested and Affected Parties	Date Comments Received	Issues Raised	EAPs Response to Issues as Mandated by the Applicant	Section and Paragraph Reference in this Report Where the Issues and or Responses were Incorporated.
		7. Further, it must be reiterated that, should an application for Environmental Authorisation be subjected to any permits or authorisations in terms of the provisions of any Specific Environmental Management Acts (SEMAs), proof of such application will be required.	7. Noted. The mine has indicated that the permit from DENC in terms of National Environmental Management: Biodiversity (Act 10 of 2004, as amended) will be required for the SWEP Phase 2 for the removal of nationally protected trees *(Vachellia erioloba* and *Boscia albitrunca*) and will be applied for after obtaining the EA.	7. Refer to section 5 in Part A.
		8. Kindly note that acceptance of your scoping report application does not grant you a right to commence with the listed activities applied for. Acceptance simply confirms that your application will be processed further and a recommendation on granting or refusal of an environmental authorisation will be forwarded to the Minister or his delegate for consideration, and the decision will be communicated as stipulated in regulation 4(1) of the EIA Regulations.	8. Noted.	8. Not applicable.
		9. You should also note that commencement with a listed activity without an environmental authorisation contravenes the provisions of section 24F (1) of National Environmental Management Act, 1998 (Act 107 of 1998), as amended (NEMA) and constitutes an offence in terms of section 49A (1) (a) of NEMA.	9. Noted.	9. Not applicable.
		10. Further note that in terms of regulation 45 of the EIA Regulations; your failure to submit the documents or meet any timeframes prescribed in terms of the said Regulations will result in your application deemed to have lapsed.	10. Noted.	10. Not applicable.
		11. Your attention is brought to Section 24F of the NEMA which stipulates "that no activity may commence prior to an environmental authorisation being granted by the competent authority".	11. Noted.	11. Not applicable.

7.4 Description of baseline environment

7.4.1 The type of environment affected by the SWEP Phase 2 project

A baseline description or *"status quo"* of the present environmental situation is provided in this part of the document. The following attributes / aspects have been described in detail, in the following respective chapters:

- Chapter A: Geology.
- Chapter B: Climate.
- Chapter C: Topography.
- Chapter D: Soils, Land Use and Land Capability.
- Chapter E: Vegetation.
- Chapter F: Fauna.
- Chapter G: Surface water.
- Chapter H: Groundwater.
- Chapter I: Air Quality.
- Chapter J: Noise.
- Chapter K: Archaeology and cultural history.
- Chapter L: Sensitive landscapes.
- Chapter M: Visual aspects.
- Chapter N: Regional socio-economic structure.

Chapter A: Geology

The following information was sourced from the *Sishen Ore Company (Pty) ltd: Sishen Iron ore Mine: Geohydrological Study and Impact Assessment for the construction and upgrading of the Western Mining Expansion Infrastructure – draft report,* compiled by Shangoni Management Services (Pty) Ltd, dated 2020.

The banded iron ore formation ("BIF") of the Asbestos Hills Subgroup is characteristically fractured and brecciated, especially near the contact with the Wolhaarkop Breccia. Both upper and lower contacts are erosion surfaces and together with the lack of easily identifiable marker horizons, make correlation of individual beds virtually impossible. A highly altered, intrusive sill is commonly found separating the BIF from the overlying laminated ore. At SIOM it is generally less than 2 m thick. The sill is invariably folded into the basinal geometry and only rarely crosscuts (intrudes) the ore bodies. Numerous intrusive dykes occur but seldom outcrop as the dykes are overlain by the Kalahari Formation and only visible on surface where the soil or sediment cover are very thin and eroded away A west-east cross section of SIOM is shown in Figure 15 and generalised version of the stratigraphy is depicted in Figure 16.

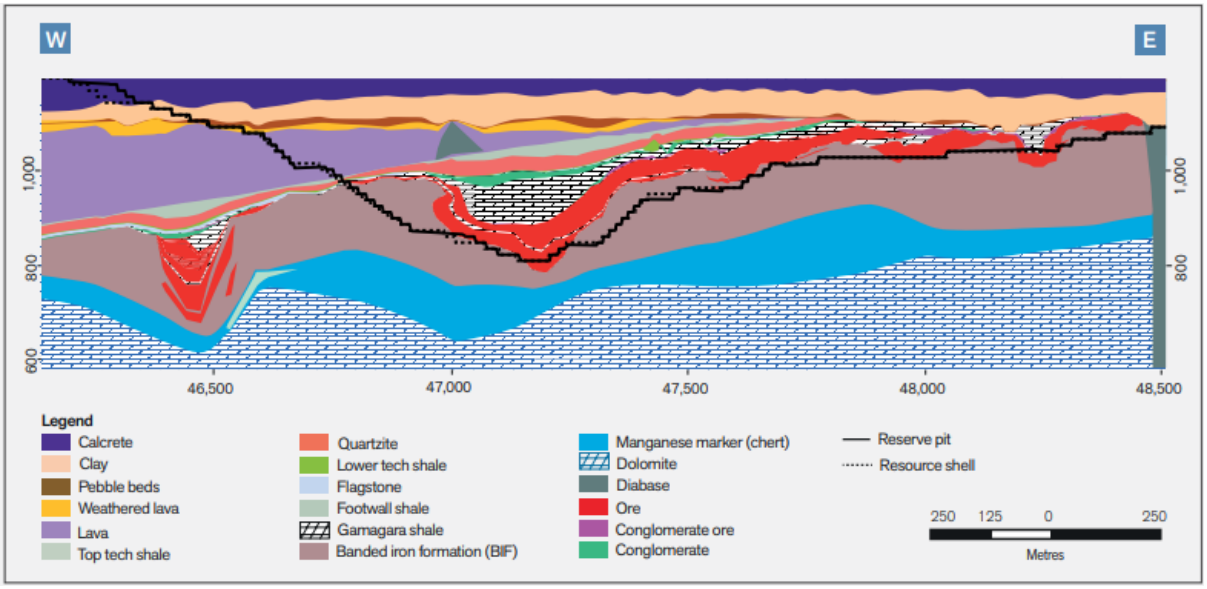

Figure 15: West-East cross-section depicting the local geology through the Sishen North Mine area (from Kumba, 2017)

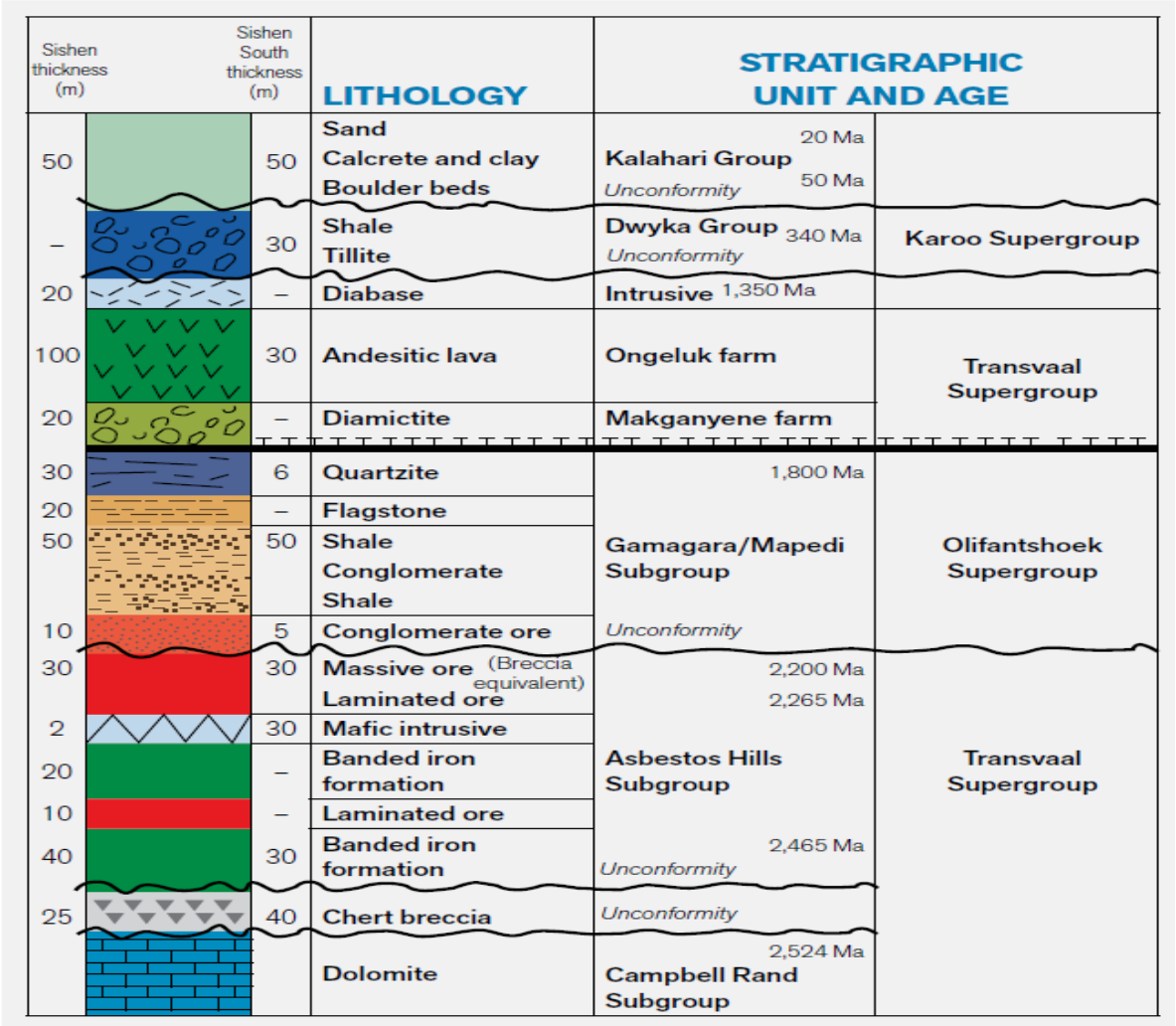

Figure 16: Simplified Stratigraphic Column (from Kumba, 2017)

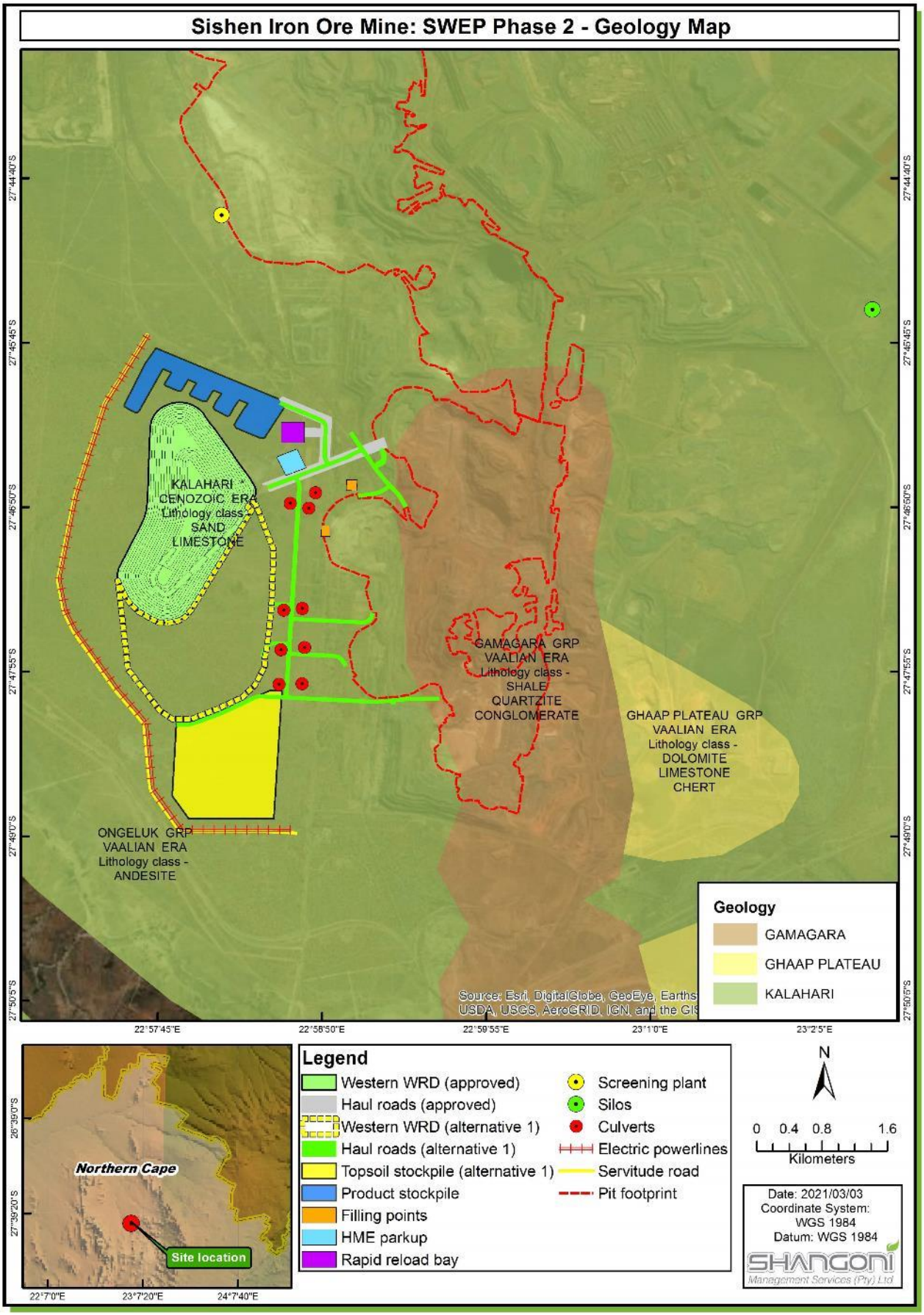

Figure 17: Geology associated with the proposed SWEP Phase 2

Chapter B: Climate

The following information was sourced from the *Sishen Ore Company (Pty) ltd: Sishen Iron ore Mine: Geohydrological Study and Impact Assessment for the construction and upgrading of the Western Mining Expansion Infrastructure – draft report,* compiled by Shangoni Management Services (Pty) Ltd, dated 2020.

The climate of the SIOM area is described to be semi-arid with a mean annual precipitation of 380 mm. This tends to fall in summer and early autumn. In addition to significant seasonal variations, quaternary catchment D41J, experiences significantly variable rainfall in the lowland areas (proximal to the mines) (360-380 mm/a) compared with the highlands (Kuruman Hills and Koranna Berg) (480 mm/a). Temperatures vary between –9°C and +42°C, with an average of 19.2°C. Average monthly rainfall data for the period 1963 to 2018 is displayed in Table 8. Mean annual evaporation (S-pan) is 2165 mm/a.

Table 8: Mean monthly rainfall data for SIOM

Month	Mean Rainfall (mm)
January	83
February	65
March	64
April	38
May	15
June	9
July	2
August	5
September	8
October	22
November	30
December	49
Annual	390

Chapter C: Topography

The following information was sourced from the *Sishen Ore Company (Pty) ltd: Sishen Iron ore Mine: Geohydrological Study and Impact Assessment for the construction and upgrading of the Western Mining Expansion Infrastructure – draft report,* compiled by Shangoni Management Services (Pty) Ltd, dated 2020.

The natural topography of the area is generally flat with some isolated undulation. The average altitude of the flat plains is at 1200 metres above mean sea level (“mamsl”). Situated in the area are a number of hills, extending up to 1350 mamsl, especially to the south-east of the SIOM mining areas close to the N14 road. Situated approximately 35 km south-west of SIOM is the Langberg. The general slope of the land is in a westerly and south-westerly direction towards the ephemeral Gamagara River. Proximal to SIOM, small hills are prominent on a north-south strike. The hills are reflective of the Maremane Anticline which trends north south. The study area is situated between two, north-south running

mountain ranges, the Kuruman Hills forming the eastern boundary of the area and the Koranna Berg Mountains, forming the western boundary of the study area. These mountain ranges are in the order of 525 m higher than the central parts of the quaternary catchment.

Chapter D: Soils, land use and land capability

The following information was sourced from the *SIOM SWEP Ecological Assessment Report, compiled by EndemicVision Environmental Services,* dated 4 December 2020.

The soils in an area are closely related to the topography and underlying geology of the area. The site has a relatively flat topography with only underlying calcretes and no outcrops.

Soils on-site are primarily red aeolian sand with surface calcretes. This is the norm for the largest part of the Kalahari region. Deeper sand soils are expected to occur to the south of the proposed layout where an increase in *Vachellia erioloba* trees are seen. *Vachellia erioloba* and *Vachellia haematoxylon* serve as indicators of Hutton soils deeper than 1m, whilst dense stands of *Senegalia mellifera* tend to dominate the same soils on slightly higher elevations (Mucina & Rutherford, 2011).

The soil type (ZA900) is Ferralic arenosols (ARo), the South African equivalent is the Hutton soil form. Ferralic arenosols are deep reddish-brown to bright brown sandy soils that occur on flat to undulating topographies. These soils tend to have absent or weak horizon development and have aeolian sand as the parent material.

Agricultural land capability in the area is low and generally suitable for light grazing, with small pockets of land on steeper slopes that are not suitable for agriculture but for conservation only. The area is generally not conducive to cultivation due to the low rainfall, semi-arid climate and shallow soil depths. Surface calcretes are common and ≥ 10 m thick.

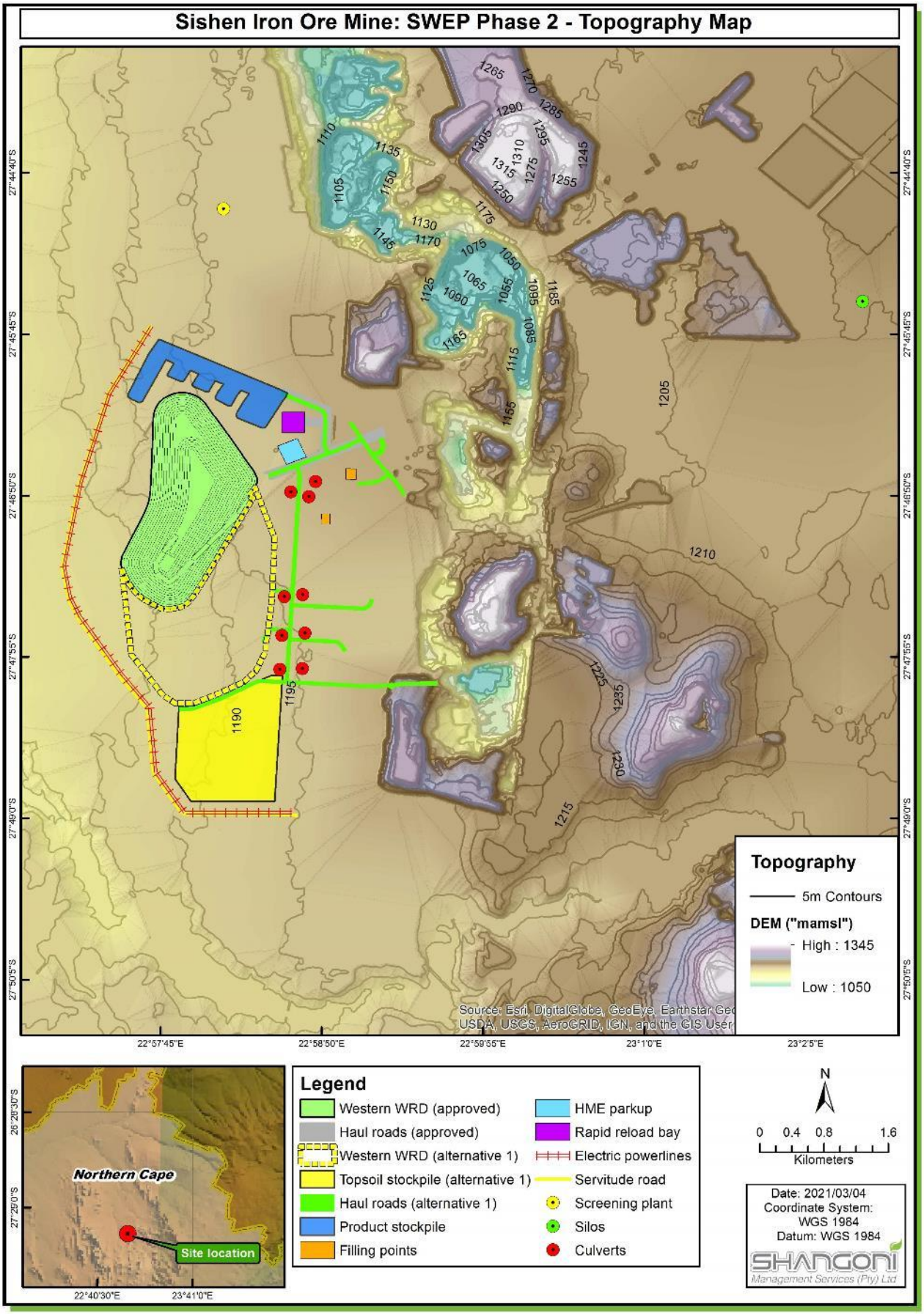

Figure 18: Map showing topography of the proposed SWEP Phase 2

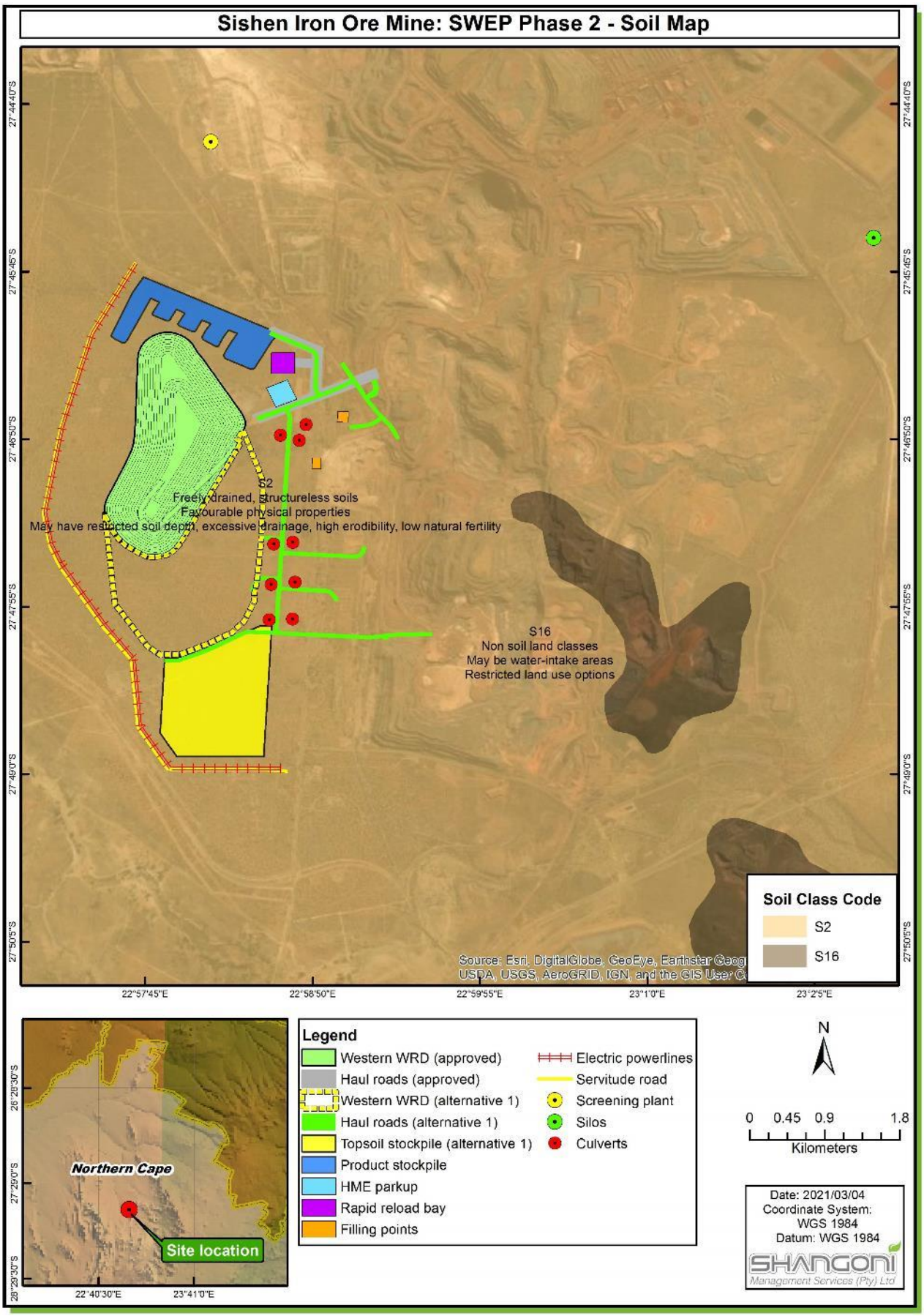

Figure 19: Map showing soils associated with of the proposed SWEP Phase 2

Chapter E: Vegetation

The following information was sourced from the *SIOM SWEP Ecological Assessment Report, compiled by EndemicVision Environmental Services,* dated 4 December 2020.

The SWEP Phase 2 is located in the Kathu Bushveld (SVk12) vegetation type. Kathu Bushveld extends from around Kathu and Dibeng in the south through Hotazel and to the Botswana border between Van Zylsrus and McCarthysrus. The vegetation type is extensive, covering more than 7 400 km² of which less than 2% has been transformed (2011 data). The vegetation type is associated with aeolian red sand and surface calcrete as well as deep sandy soils that lend to differential habitats within the vegetation type. Kathu Bushveld is, however, poorly conserved and does not currently fall within any formal conservation areas.

The vegetation of the site consists of Bushveld, with a well-developed grass layer and a variable-density tree layer. The bushveld has *Acacia mellifera* bush clumps that occur across the site, open woodland elements (Camelthorns and Sheperd trees) and Prosopis stands with isolated calcrete banks.

The grass layer is fairly homogenous across the site and there is not a lot a variation in the grass layer which can be ascribed to the sandy substrate. The common woody species present at the site include *Tarchonanthus camphoratus, Zizyphus mucronata, Gymnosporiabuxifolia, Senegalia mellifera subsp. detinens, Searsia ciliata, Ehretia rigida subsp. rigida, Diospyros lycioides subsp. lycioides and Grewia flava. The grass layer is dominated by Schmidtia pappophoroides, Aristida meridionalis, Aristida stipitata subsp. stipitata, Stipagrostis uniplumis var. uniplumis, Stipagrostis obtusa, Cynodon dactylon, Enneapogon desvauxii, Eragrostis lehmanniana* and *Aristida congesta subsp. congesta*. The density and diversity are shrubs is fairly low but includes *Asparagus laricinus*, *Asparagus retrofractus, Felicia muricata subsp. cinerascens, Pentzia calcarea, Acacia hebeclada, Hermanniatomentosa, Gnidia polycephala* and *Lantana rugosa*.

More than 1% of the Kathu Bushveld have already been transformed by SIOM in 2006 (Mucina & Rutherford, 2011).

The area is further located within the Griqualand west centre of endemism, which contains several range-restricted plant species. The Griqualand West Centre of endemism is however mainly associated with the rocky outcrops of the region and hence the presence of the deep aeolian Kalahari sands and associated *Vachellia erioloba* trees relates more closely to the vegetation associated with the Kalahari sands than that of the Griqualand west centre of endemism.

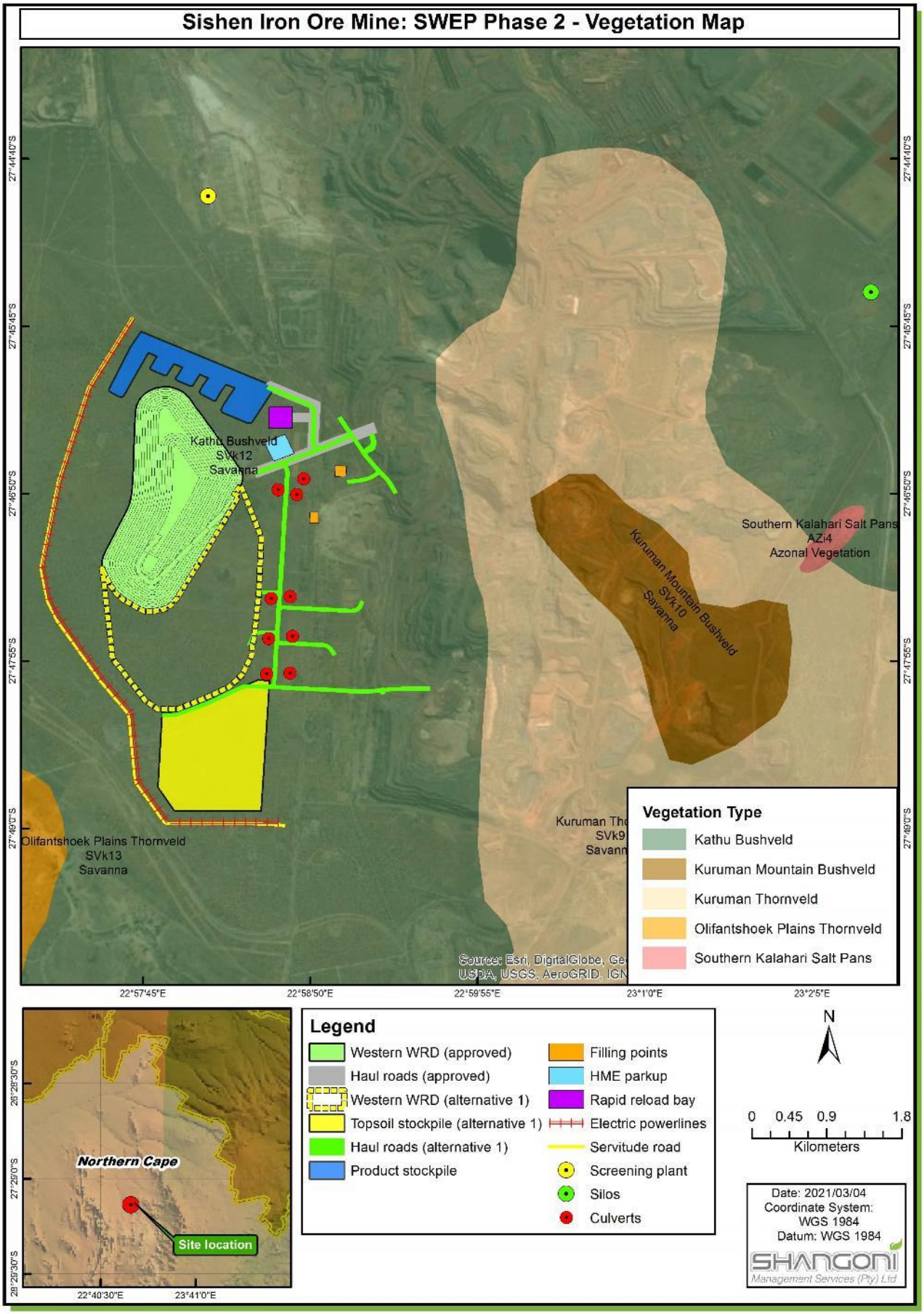

Figure 20: Vegetation associated with the proposed SWEP Phase 2

Chapter F: Fauna

The following information was sourced from the *SIOM SWEP Ecological Assessment Report,* compiled by EndemicVision Environmental Services, dated 4 December 2020.

Based on the habitats present on site different fauna species are expected to occur. The forest/woodland habitat where Vachellia erioloba trees are dominant has deep sandy soils and large trees which provide habitat for several avifaunal/bird species as well as burrowing animals such as the *Orycteropus afer* (Aardvark). The grass layer of this habitat type further serves as fodder for numerous grazers such as the *Sylvicapra grimmia* (Duiker) and *Raphicerus campestris* (Steenbok).

Areas invaded by dense stands would serve as habitat for similar avifaunal species but lacks the grass cover and deep aeolian sands. Thicket habitats are favoured by browsers, whilst the calcrete plains are expected to attract smaller rodents and some herpetofauna species. Ephemeral pan habitats provide shelter to the widest diversity of faunal species, ranging from avifauna and herpetofauna to larger mammals which graze the floral species present.

Chapter G: Surface water

The following information was obtained from the *Sishen Iron Ore Company (Pty) Ltd: Sishen Iron Ore Mine Integrated Water and Waste Management Plan*, dated 2020 and compiled by Shangoni Management Services (Pty) Ltd.

The SIOM operation is situated within the Orange River primary catchment area and the Vaal River water management area. The Northern Cape Department of Water and Sanitation (“DWS”) is the responsible water authority.

Several pans and wetlands are found in the area following rain events.

The Gamagara River channel can carry both the 100-year and 50-year floods, without significant flooding. Floodwaters do not reach the railway line between the southernmost section of the mine and the Gamagara River. Hence the mine workings and associated infrastructure can be regarded to be located outside the 100-year and 50-year flood lines.

Due to the episodical nature of the Gamagara River, combined with a poor gauging network, no Mean Annual Runoff (“MAR”) can be established. The river is dry for possibly 97% of the time, but strong flows occur during heavy downpours, as sometimes happens during the summer rainfall season, and especially when the antecedent moisture content in the catchment is high, after successive storm events. These flows last at most for a few days before the water disappears into the riverbed along the length of the river.

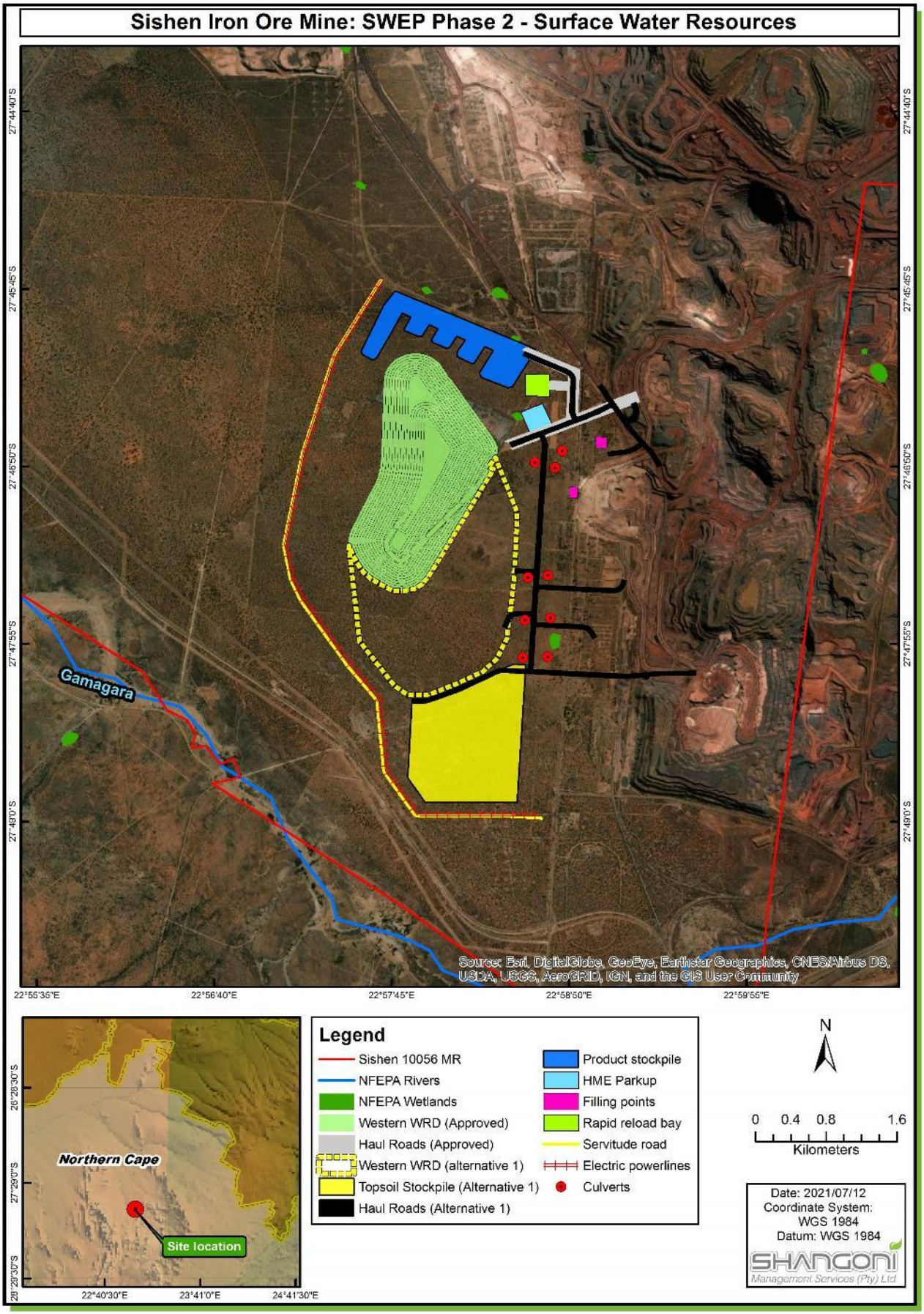

Figure 21: Surface water resources associated with the SWEP Phase 2

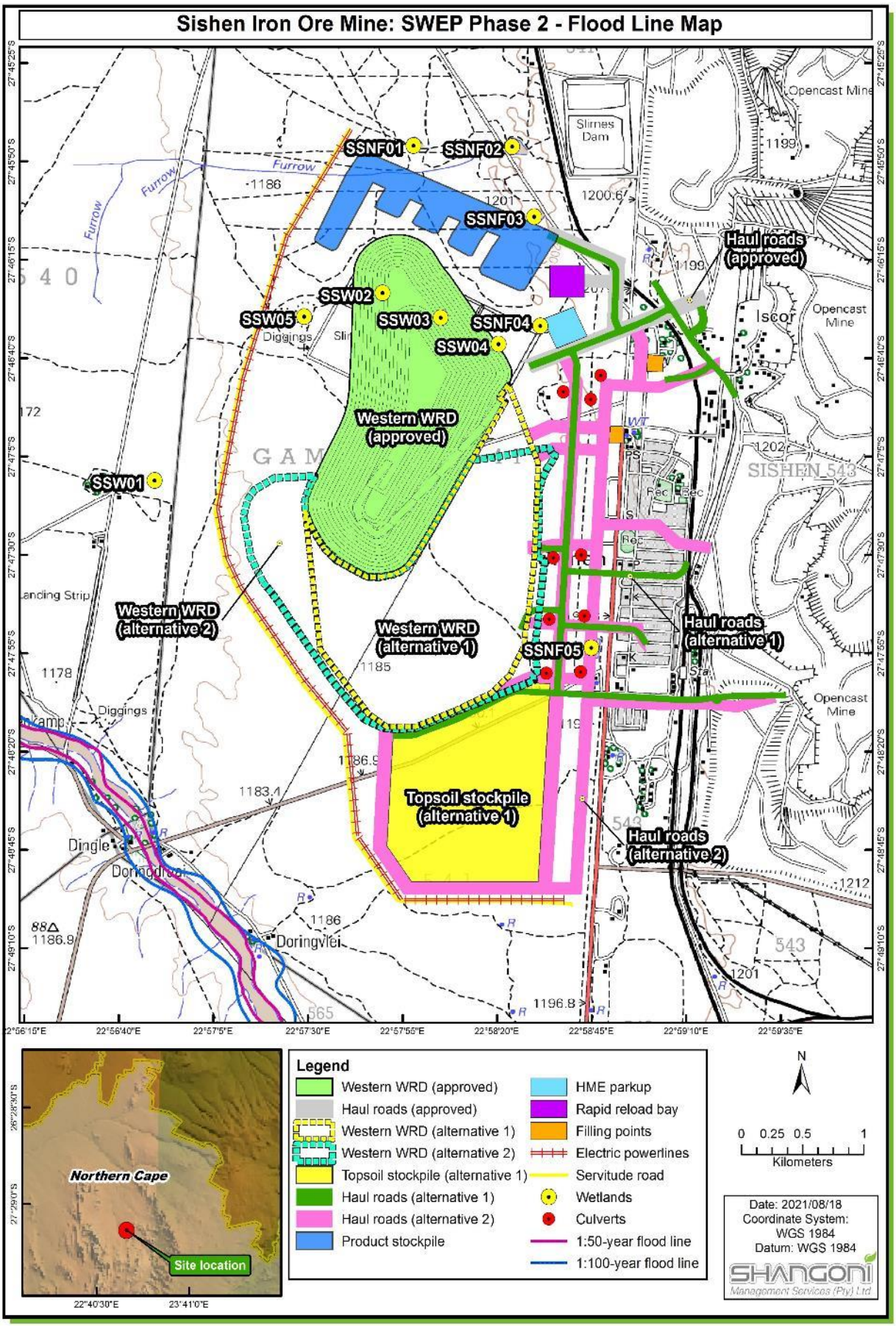

Figure 22: 1:50 and 1:100-year flood line

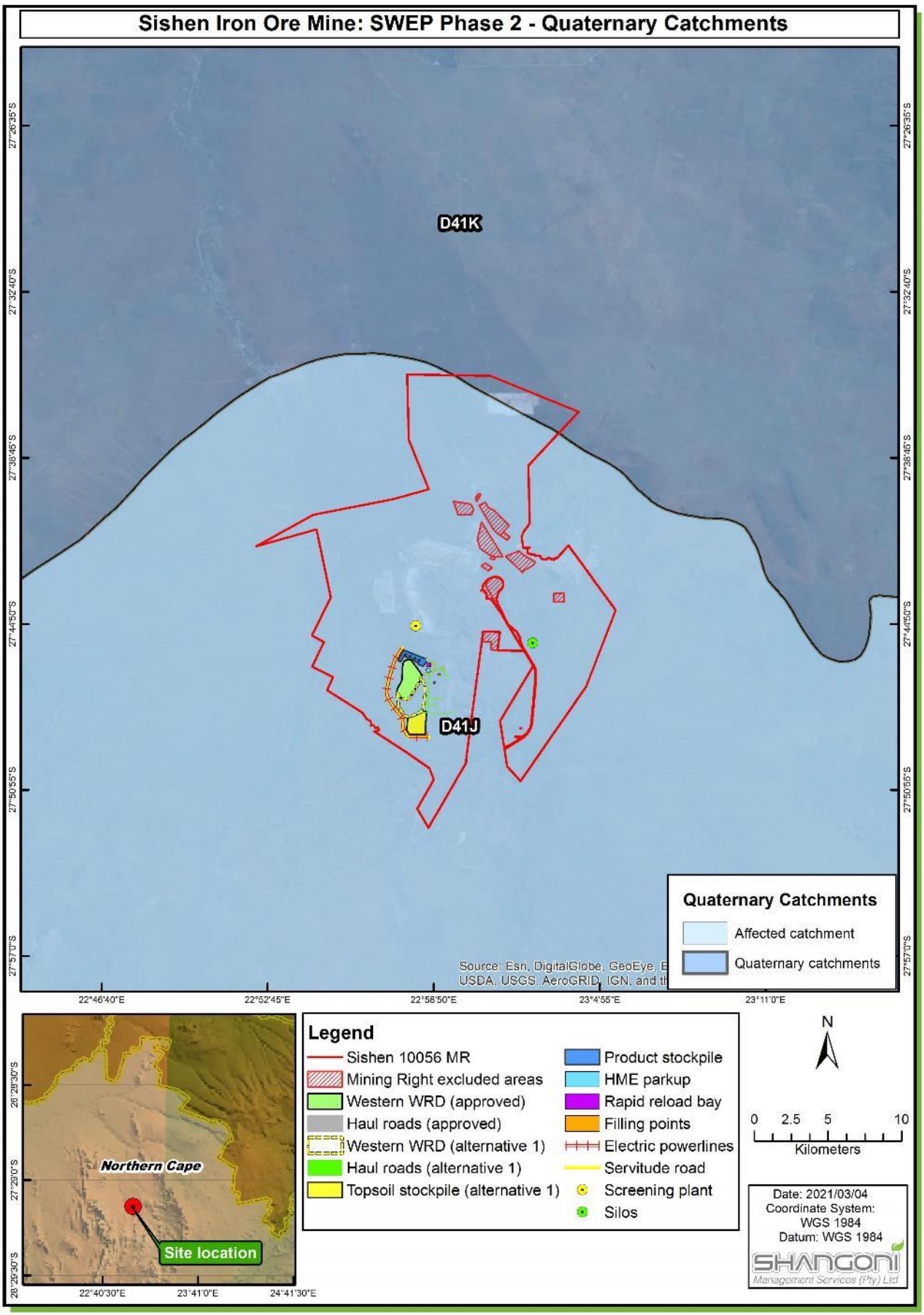

Figure 23: Catchments associated with proposed SWEP Phase 2

Chapter H: Groundwater

The following information was sourced from the *Sishen Ore Company (Pty) ltd: Sishen Iron Ore Mine: Geohydrological Study and Impact Assessment for the construction and upgrading of the Western Mining Expansion Infrastructure – draft report,* compiled by Shangoni Management Services (Pty) Ltd, dated 2020.

The characteristics of vadose zone vulnerability dominating factors are closely related to the migration and transformation mechanisms of contaminants in the vadose zone, which directly affect the state of the contaminants percolating to the groundwater. The permeability and thickness of the unsaturated zone are some of the main factors determining the infiltration rate, the amount of runoff and consequently the effective recharge percentage of rainfall to the aquifer. The type of material forming the unsaturated zone as well as the permeability and texture will significantly influence the mass transport of surface contamination to the underlying aquifer(s). Factors like ion exchange, retardation, biodegradation and dispersion all play a role in the unsaturated zone.

A calcrete and clay layer with a combined thickness of ≥30 m underlies SIOM. It is expected that a weathered aquifer exists within the study area in these regions. The water levels recorded for the monitoring boreholes at SIOM vary considerably with minimum of 0.1 metres below surface (“mbs”) to 88.21 mbs with a median of 5.50 mbs.

Two major aquifer systems have been identified in the region (Meyer, 2009). The deeper secondary aquifers are present in the dolomite and Banded Iron Formation (“BIF”). These aquifers are associated with fracturing and weathering of the formations and are compartmentalised with dykes and other aquitards, such as the Dwyka Group (tillite) and some formations of the Kalahari Group (Ages, 2011, 2017). The groundwater flow is controlled by the regional dykes and faults. A shallow aquifer is developed within the Kalahari sediments, mainly within the calcrete beds (Golder, 2019]. A shallow alluvial aquifer is also associated with the Gamagara River alluvial deposits. The shallow aquifers can be separated from the deep aquifers by lower permeability dykes or clayey layers. There is reference to a confined fractured Dwyka aquifer that overlies older lithologies of the Ongeluk Andesite and Asbestos Hills formations (Ages, 2011, 2017).

A relatively good correlation was achieved between hydraulic heads recorded for SIOM and topography. An assumption can therefore be made that groundwater flow patterns and gradients will mimic surface water flow. Groundwater flow will be directed from a high hydraulic pressure head towards a low hydraulic pressure head, similar to surface water, which is from a high topographical area to a low topographical area. The hydraulic heads as recorded during the hydrocensus and average groundwater levels for the monitoring boreholes were used to construct a hydraulic head contour map for the SIOM mining area. Where data points were lacking, an interpolation technique known as Kriging was used to interpolate data points at an unobserved location with respect to data points in close relation to it (mathematically related to regression analysis).

The following represents the elevation in metres above mean sea level ("mamsl") of the shallow aquifer:

- A gradual decline occurs from the eastern highlands (i.e., the Kuruman Hills) towards the west which indicates this area as the main recharge area in the wider study area.
- The piezometric surface decreases form ~1300 mamsl in the Kuruman Hills towards the north-west and south-west with elevations at ~1000 mamsl.
- The piezometric surface at SIOM is impacted by high groundwater abstractions.
- Several small-scale abstractions are visible within the wider area.
- The new proposed WWRD 5 and study area (indicated by black square) seems to be located on a groundwater divide, partly the consequence from pit dewatering and the gradient that exists between the hydraulic head that exists below the pit and ambient heads.
- Based on first principles, flow from the study area, and specifically from the new proposed WWRD 5, will be west, and east towards the pit.

Falling head aquifer tests were conducted on 14 boreholes within the study area. The data displayed in that the hydraulic conductivities of the shallow and deeper aquifers are low with averages of 0.04 m/d and 0.03 m/d calculated with the FC Method and Aqtesolv software. It is therefore expected that pollution transport and migration in the aquifer underlying the study area are slow processes as it is ultimately governed by the permeability (hydraulic conductivity) of the aquifer.

Chapter I: Air Quality

The following information was obtained from the *Sishen Iron Ore Mine Dustfall Monitoring Sampling Report,* compiled by Gondwana Environmental Solutions, dated December 2020*.*

The prevalent wind direction at Sishen Weather Station for December 2020 was from the north (17.0%) and north-north-west (11.0%). All other winds had a frequency of occurrence of less than 10%. The highest wind speeds (8 to 10 m/s) occurred 0.3% of the time. Calm conditions (< 0.5 m/s) occurred 7.7% of the time. Dust sources located in areas that experienced the highest wind speeds and/or highest frequency of occurrence (above 10%) are likely to contribute to increased dustfall in the areas downwind of the sources.

Overall, five exceedances have occurred during the last 12 months from three sites (both Non-Residential). Non-permitted exceedances have occurred at one non-residential site. The dustfall network is currently 97% compliant.

Chapter J: Noise

A noise study was conducted for the SWEP Phase 2, the results of which were incorporated into the report titled, *Noise Study for Environmental Impact Assessment for the Proposed Phase 2 of the Sishen Western Expansion Project Near Kathu, Northern Cape Province*, dated November 2020, compiled by Enviro-Acoustic Research cc.

As part of the above-mentioned study, measurements were conducted to determine the current ambient noise levels at sensitive receptors near the proposed SWEP Phase 2. The following findings were made:

- The prevailing noise levels in and around the study area was found to be typical of the noise levels expected within a mining district with a decrease in the noise level the further one moves from the mining and processing plant activities.
- Residential dwellings (verified) within the project area are not subject to noise levels exceeding 45 dBA due to the mining activities of SIOM.

Considering the results of the measurements, ambient sound levels in the vicinity of the project site are variable. Ambient sound levels are low away from mining activities, though the sound levels would increase closer to the mining activities. Based on the measurements at the two residential properties, ambient sound levels are also elevated at these houses, mainly due to natural and residential related noises.

Chapter K: Archaeology and Cultural History

The following information was obtained from the *1st phase H.I.A. of a proposed extension and upgrading at Sishen Mine, also known as phase two of the Sishen Western Expansion Project that is located on portions of Gamagara and Doornvlei, Northern Cape for Sishen Mine*, compiled by Sidney Miller dated December 2020.

The general area is known to contain both Early as well as Later Stone Age sites as well as engraving sites. The nearby Kathu Pan is a good example of these early peoples presence in the area under investigation. No significant assemblages of Stone Age (either Early, Middle or Later) artefacts were observed. Neither were there any engravings or other rock art panels observed. In the general area the only known Iron Age sites is those situated more to the north and east of Kuruman the area investigated revealed no indication of Iron Age settlement. On the area investigated the recycled remains of most of the old Sishen (Dingleton) Town was observed. The demolition process was initiated circa 2003 and a few final buildings are in the process of being demolished. On places located in the historical recording remains of a pump station, sludge dams and settlement tanks were observed. The sludge dams have no heritage value, and the other two structures have long ago been stripped of machinery employed. There are no sites of cultural/spiritual significance located on or near the property under investigation. There are no sites connected to slavery located on or near the property under investigation. There are no people of importance connected to the history of the study area. There is no special technological or scientific advancement of standing that can be linked to the property under investigation.

Chapter L: Sensitive Landscapes

The following information was obtained from the *SIOM SWEP Wetland Assessment Report,* compiled by EndemicVision and dated December 2020.

The project area is categorised as Ecological Support Areas and Other Natural Areas based on the Critical Biodiversity Areas map (Northern Cape Department of Environment and Nature Conservation, 2016). Five NFEPA listed wetlands are present on the site that serve as sensitive habitats where higher biodiversity is expected. Wetlands occurring in the project area, according to the NFEPA database can be seen in the figure below (NFEPA wetlands are shown as SSNF01-05). A connected wetland system

is found to the north of the SWEP Phase 2 project area (SSNF01-02). Five additional wetlands were observed on site and were also included in the assessment. These include a natural wetland situated west of the project area within the buffer zone, an artificial wetland within the project area and the old tailings storage facility ("TS") functioning as three separate wetlands. All wetlands assessed are depicted in the figure below (all other identified wetlands are shown as SSW01-05). According to the descriptions provided by the NFEPA data set, SSNF01, SSNF02 and SSNF 03 are described as natural or good (AB). The PES score derived from the site assessment places SSNF01 and SSNF03 in the unmodified or natural category (A). SSNF02 is placed in the predominantly natural category (B) that has few modifications). These activities include the construction of a haul road crossing this wetland. The NFEPA condition for SSNF04 and SSNF05 are placed in the C category that indicates that the wetland is moderately modified. The PES scores derived from this assessment indicate that both these wetlands are largely natural with a few modifications (B). Although artificial wetlands can be very valuable due to its functionality as a habitat, PES rating is not appropriate to be used. SSW02-05 are thus omitted from this assessment. The EIS scores determined for each wetland through the adaptation of the DWS (1999) methodology for floodplains. All NFEPA wetlands within the study area fall within the C category (Moderate). These wetlands are considered to be ecologically important and sensitive on a provincial or local scale. According to this categorisation, the biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. This could be prescribed to the fact that these wetlands are mostly single disconnected wetlands within the terrestrial habitat.

Chapter M: Visual aspects

The following information was obtained from the *Visual Impact Assessment as part of the Environmental Impact Assessment and Authorisation Process for the proposed Sishen Western Expansion Project Phase II, near Kathu, Northern Cape Province,* compiled by Scientific Aquatic Services and dated 2021.

The arid nature of the climate restricts stocking densities which has led to relatively large farms across the area, resulting in the area being sparsely populated. Farmers and farm workers residing in the area and people at their place of work are sensitive receptors. As noted, the sparse farmsteads located in the vicinity of the expansion activities are accustomed to the mining activities in the area therefore the sensitivity of residents may be considered moderate. People at their place of work are likely to focus on the activities at hand and not the surrounding environment as such workers are also considered moderate sensitive receptors. Since the proposed expansion area is situated within a remote area, the only main road within the area is the N14 which is predominantly utilised by mine and farm workers and people traveling between Johannesburg and Springbok. Furthermore, the R325 and several farm roads are present in the area, which are utilised infrequently and predominantly by mine workers. Due to their momentary views and experience of the receiving environment motorists are classified as low sensitive receptors.

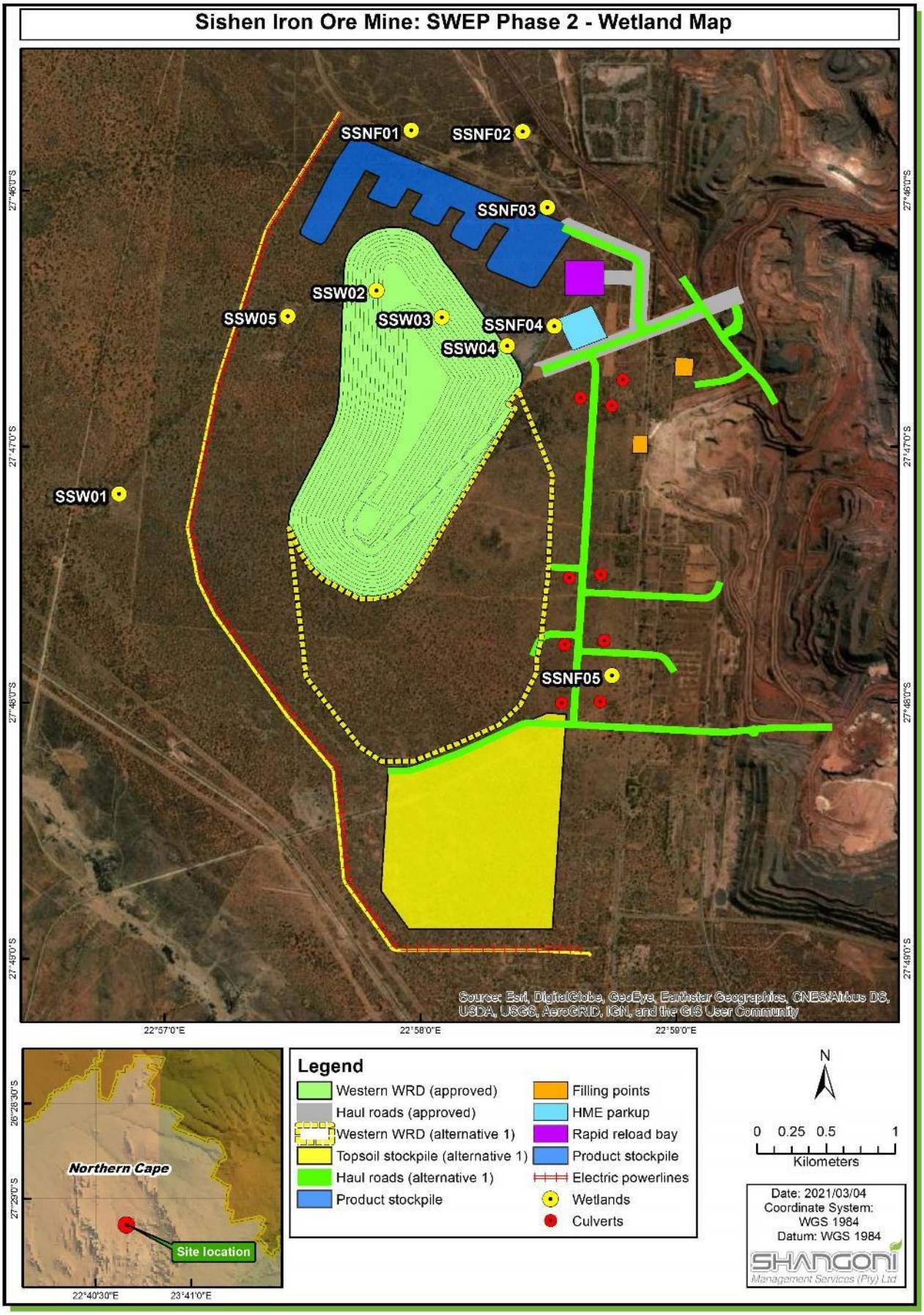

Figure 24: Wetland map associated with SWEP Phase 2

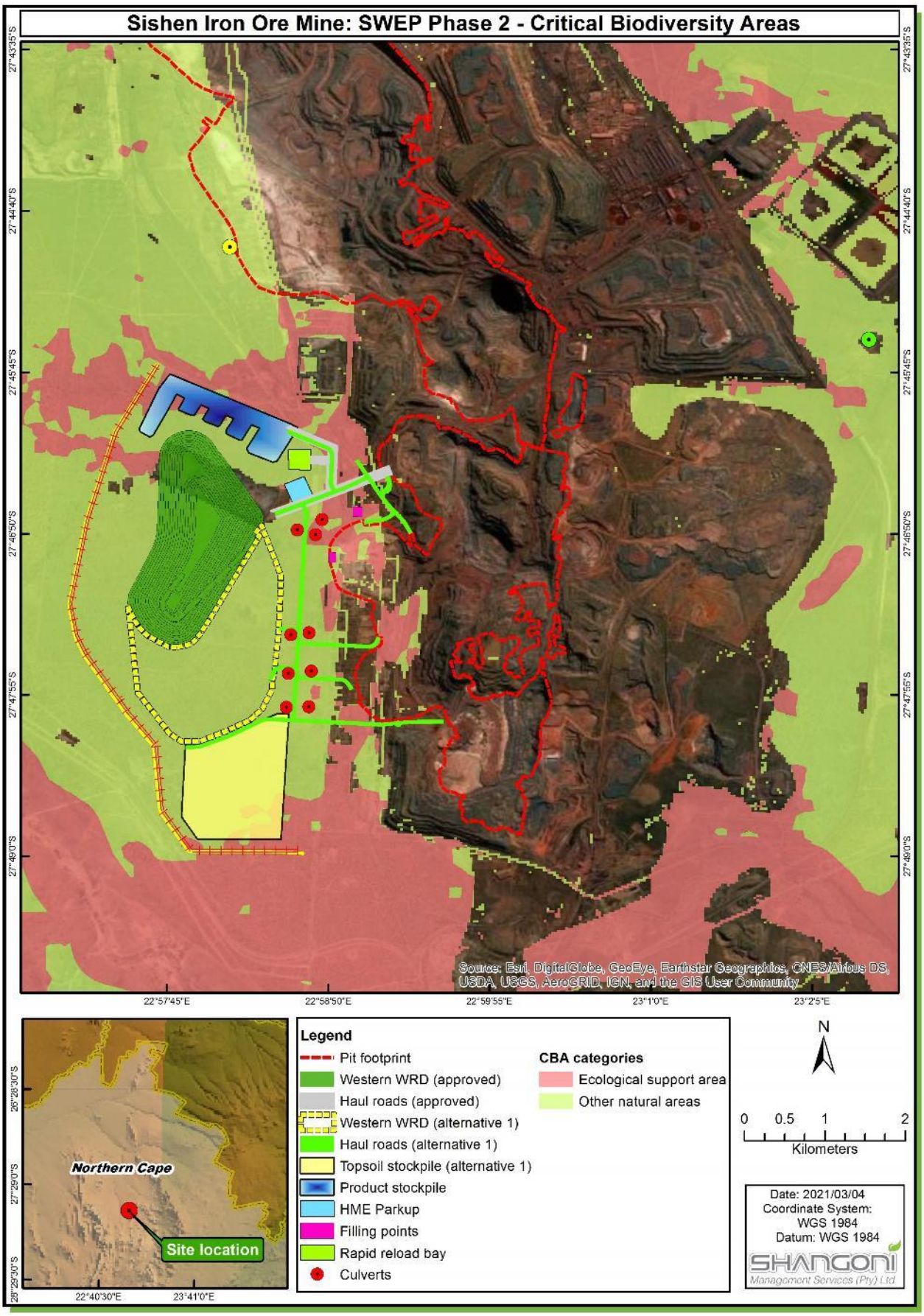

Figure 25: Critical Biodiversity Areas associated with the SWEP Phase 2

Chapter N: Regional socio-economic structure

The following information was obtained from the *Integrated Development Plan: John Taolo Gaetsewe District Municipality,* dated 2020.

Geographically, the Northern Cape Province is the largest province in South Africa, covering an area of 372 889 km^2, which constitutes approximately 30% of the country's total area. Despite having the largest land mass, the province is the least populated of all nine provinces. Per Census 2016, the province's population was 1 145 859, or 2.2%, of the national population. The province is bordered by Namibia and Botswana in the north; while domestically, it is bordered by Northwest Province borders in the north-east, the Free State Province in the east, the Eastern Cape Province in the south-east, and the Western Cape Province to the south and south-west. The Northern Cape consists of five districts, namely Frances Baard, Pixley ka Seme, Namakwa, ZF Mgcawu (previously known as Siyanda) and John Taolo Gaetsewe.

The John Taolo Gaetsewe District Municipality ("JTGDM"), which lies in the north-east of the Northern Cape Province, is geographically the second smallest of the five district municipalities in the province, covering a surface area 27 293 km^2 (6% of the province). It is bordered by the Siyanda District in the east, Botswana in the north, Francis Baard District to the south, and the North-West Province in the west. The JTGDM accounts for about 16% of the provincial population.

The Gamagara Local Municipality ("LM") covers a surface area of 2 619 km^2, which is approximately 10% of the district's total surface area. It is located in the north-eastern sector of the Northern Cape, bordered by Ga-Segonyana LM in the east, Joe Morolong LM in the north, while Tsantsabane LM forms its south and west borders. Kathu serves as the LM's administrative centre, and it is primarily an iron ore and manganese mining area. The municipality has four major urban settlements - Kathu, Olifantshoek, Dibeng and Mapoteng/Sesheng. Dingleton was previously the fifth major settlement, but with the expansion of SIOM, residents had to be relocated, a process that began in 2014.

The local economy is largely dependent on the mining sector, which contributed 32.9% or R1 433 million towards the Gamagara LM economy in 2016. The rest of the municipal economy comprises largely of the tertiary sector, aimed at servicing the local population and businesses, including SIOM. Contributions from the retail trade (17.1%), personal services (13.6%) and transport (11.6%) industries carry the most weight in this sector. Retail activity has increased significantly over the past decade, as it is reliant on the population size and available disposable income.

Agriculture's contribution to the local GDP was limited to 2.0% in 2016, and it is expected that it will not change significantly in the future. The regions climate as well water scarcity limits the type of agricultural activities that can be carried out in the area. The municipality's manufacturing sector is very weak (3.1% of the local economy), and while the contribution of the manufacturing sector to the local economy has been declining over the years, that of the construction sector has been growing. High dependency on mining activities leaves the economy of Gamagara and its communities vulnerable to the volatile factors discussed above. While local government acknowledges the importance of the mining industry in the local economy, it also promotes diversification of local economic activities in order to reduce the risks

and reliance and performance of the mining industry. As such, various local economic development ("LED") initiatives are pursued by local government in partnership with various stakeholders, including SIOM.

7.4.2 Description of the current land uses

Farming activities are the predominant land uses type in the vicinity. The current land use for the properties associated with the proposed project is mining. Refer to the figure below for an illustration of land cover associated with the area.

7.4.3 Description of specific environmental features and infrastructure on the site

The specific environmental features on site related to flora, fauna, and wetlands have been described in the relevant chapters in Section 7.4.1 of Part A. In addition to the above, the proposed infrastructure on site is discussed in Section 4.3 of Part A.

7.4.4 Environmental and current land use map

Refer to the figure below for an indication of the current land use and land cover.

7.5 Impacts and risks identified

The following section contains all the potential impacts and risks identified for the SWEP Phase 2 and were sourced from the relevant specialist studies conducted for the project.

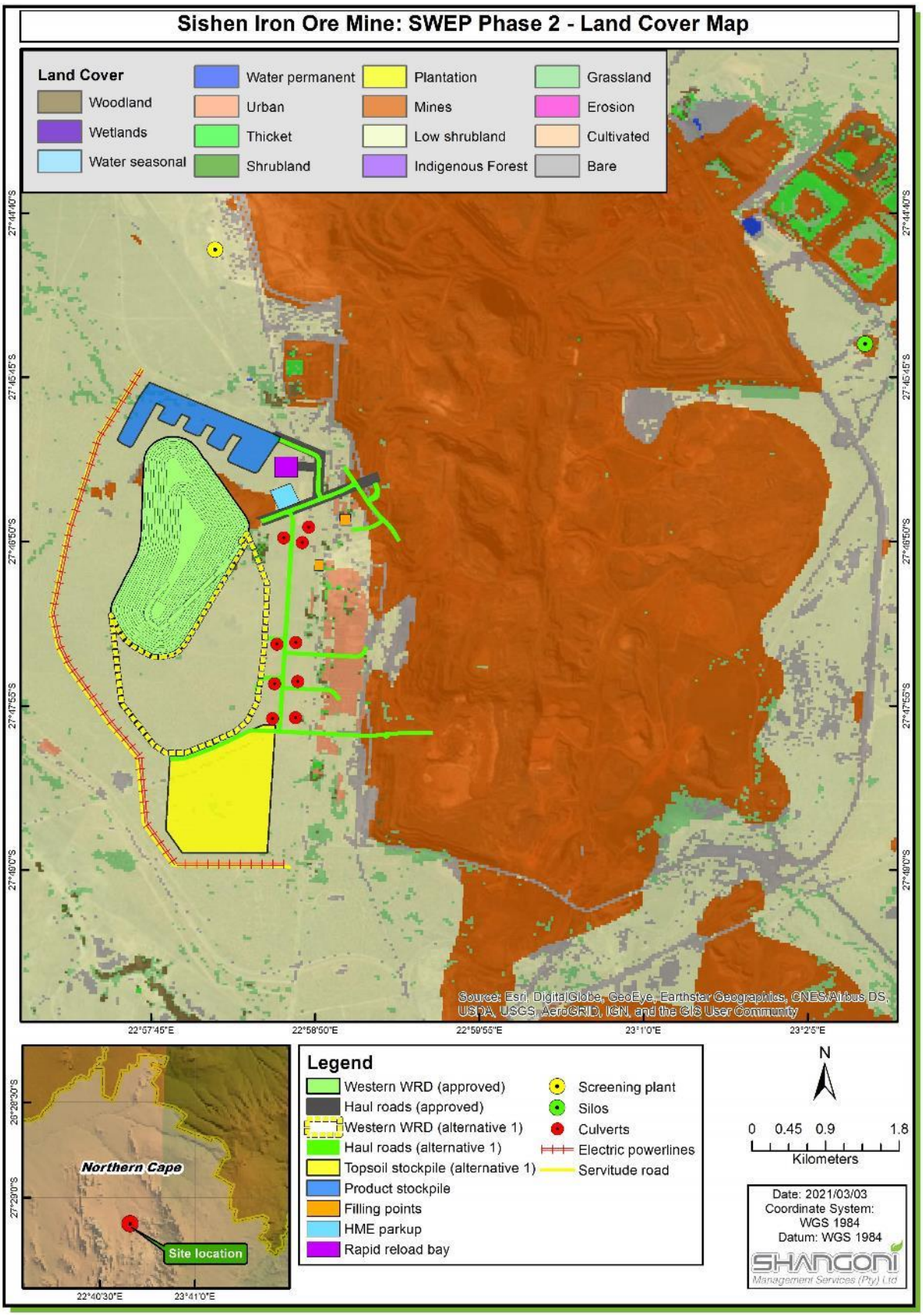

Figure 26: Current land use map

7.5.1 Impacts and risks associated with the SWEP Phase 2

Table 9: Impacts and risks identified for the SWEP Phase 2

No.	Aspect affected	Alternatives	Activity	Potential Impact	Reversibility	Irreplaceable loss	Phase	Size and scale of disturbance	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
									Probability	Magnitude	Significance		Probability	Magnitude	Significance
1	Geology	Waste rock dump and haul alternatives[3]	For all project phases: No impact to geology will occur as a result of the proposed SWEP Phase 2.												
2	Topography	Waste rock dump and haul alternatives	Alteration of the natural drainage patterns.	The disposal of waste rock on the Western Waste Rock Dump 5 will influence the nature of the topography that is typical of the surrounding area. Changes to the topography of the site will increase the amount of run-off from site as the waste rock dump has a higher surface area than flat plains.	Irreversible	High Degree	Construction and Operational	750 ha	2	3	Medium	Control	2	2	Low
3	Soils, land use and land capability	Waste rock dump and haul alternatives	Clearing of soil	The removal of topsoil may result in the mixing of the horizons of the soil that will have an impact on the fertility and production potential of the soil. Soil compaction and topsoil loss through erosion may occur as a result of the mining and mining related activities (including the temporary stockpiling). This will further lead to a loss of soil fertility.	Reversible	Medium Degree	Construction and operational	750 ha	3	2	Medium	Control	2	2	Low
4	Surface water	Waste rock dump and haul alternatives	Grading, vegetation clearing and soil stripping	There may be a deterioration in surface water quality when any surface water runoff comes into contact with dust, eroded soil, or other pollutants generated during the construction phase of the proposed SWEP project. The sediment load within surface water runoff may increase if not prevented or mitigated, or the chemistry of surface water may be altered. Surface water quality: Siltation of water resources causes deterioration of water quality, affecting the use of surface water as a natural resource.	Partially reversible	Medium Degree	Construction	750 ha	3	2	Medium	Control and prevention	2	1	Low
			Use of hazardous materials	Spillages of hazardous materials (i.e., cement, oil, fuel and / or grease) used during the construction phase of the SWEP Phase 2 project may impact on the surrounding clean water environment. Surface water quality: Deterioration of water quality due to chemical contamination affecting the use of surface water as a natural resource.	Reversible	Medium Degree	Construction	750 ha	3	2	Medium	Control and prevention	2	1	Low
			Silos (Ammonium Nitrate)	Spillages of ammonium nitrate leading to contamination of surface water.	Reversible	Medium Degree	Operational	0.5 ha	3	2	Medium	Control and prevention	2	1	Low

[3] Where no alternatives are listed, indicates the specialist did not identify other impacts relevant to the alternatives.

No.	Aspect affected	Alternatives	Activity	Potential Impact	Reversibility	Irreplaceable loss	Phase	Size and scale of disturbance	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
									Probability	Magnitude	Significance		Probability	Magnitude	Significance
			Western Waste Rock Dump 5 (“WWRD 5”) Waste Rock Dump (“WRD”)	The WWRD 5 will cover an area of approximately 250 ha and will be roughly 120 m in height. Waste rock from the adjacent pit will be disposed of onto the WRD for the remainder of SIOM’s Life of Mine (“LOM”). The waste rock material is classified as relatively inert with little pollution potential and no acid generating capacity. However, the WRD contains material particles varying in size from large rocks to fine dust particles. The smaller fraction of these particles is suspended by runoff generated during rainfall events, thus elevating the suspended solids load of the runoff. It is, therefore, assumed that runoff from the WWRD 5 could have a pollution risk, mainly in terms of sedimentation, and all water generated on the WWRD 5 should be considered affected water. The proposed containment berm around the entire WRD will reduce surface water quality impacts, but it will lead to a substantial reduction in runoff reporting to the downstream environment. <u>Surface water quality:</u> Siltation will result in a deterioration of water quality, affecting the use of surface water as a natural resource. <u>Surface water quantity:</u> There will be a decrease in clean water runoff reporting to the catchment, potentially reducing the availability of water to downstream users.	Partially reversible	Low Degree	Operational	250 ha	2	2	Low	Control and prevention	1	1	Low
			Product Stockpile	A 65 ha product stockpiling area will be constructed for the stockpiling of C-grade iron ore. According to the IWWMP (Shangoni, 2019), at the existing stockpiling areas the contamination is limited to predominantly red dust that has a low pollution risk. The dust discolours the storm water runoff but is inert. The stockpiling area will also contain material particles that can be suspended by runoff generated during rainfall events, increasing the sediment load of runoff, and reducing surface water quality. The proposed containment berm around the product stockpile will reduce surface water quality impacts but it will lead to a reduction in clean runoff water reporting to the downstream catchment. <u>Surface water quality:</u> Siltation will result in a deterioration of water quality, affecting the use of surface water as a natural resource. <u>Surface water quantity:</u> There will be a decrease in clean water runoff reporting to the downstream catchment, potentially reducing the availability of water to downstream users.	Reversible	Low degree	Operational	65 ha	2	2	Low	Control and prevention	1	1	Low

No.	Aspect affected	Alternatives	Activity	Potential Impact	Reversibility	Irreplaceable loss	Phase	Size and scale of disturbance	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
									Probability	Magnitude	Significance		Probability	Magnitude	Significance
			Topsoil Stockpile	The area to the south of the WWRD 5 will be used to stockpile topsoil stripped from the footprint areas of the proposed infrastructure. Runoff from this area will have a high sediment load if it comes into contact with the topsoil. Additionally, the stockpiles could be eroded by runoff during rainfall events, which will result in a loss of precious topsoil that should be used for rehabilitation purposes. The proposed containment berm around the stockpile will reduce surface water quality impacts, but it will lead to a reduction in the amount of runoff reporting to the catchment. <u>Surface water quality:</u> Increased sedimentation from the topsoil stockpile will result in a deterioration of water quality, affecting the use of surface water as a natural resource. <u>Surface water quantity:</u> There will be a decrease in clean water runoff reporting to the catchment, potentially reducing the availability of water to downstream users.	Reversible	Low degree	Operational	115 ha	2	2	Low	Control and prevention	1	1	Low
			Rapid reload bay and HME Parkup	A rapid reload bay will be constructed for the temporary storage of high energy fuel (i.e., emulsion) to be used for blasting. The high energy fuel will be stored in five 76 000 ℓ mobile tankers. The mobile tankers will collect high energy fuel at the HEF plant and transport it to the rapid reload bay. From the rapid reload bay fuel will be transferred into smaller tanker trucks that will transport the emulsion to the blasting area. The 76 000 ℓ mobile tankers will only be parked in the rapid reload bay during the day, after the transfer of fuel is complete, the tankers will return to the HEF plant, and the process will be repeated the next day (or when fuel for blasting is required). There will therefore not be any permanent storage of high energy fuel in the rapid reload bay. Should the emulsion containing tanks leak or burst, it could lead to surface water contamination. Spillages of emulsion may occur during the transfer of fuel from the large tankers to the smaller tankers, which could lead to the contamination of surface water resources. Runoff generated upstream of the rapid reload bay will drain westwards towards the facility and if left unmitigated, clean runoff could come into contact with substances that have the potential to pollute surface water (i.e., emulsion, oil, fuel and / or grease) and reduce water quality. <u>Surface water quality:</u> Deterioration of surface water quality due chemical contamination resulting from leaks, spillages or bursting tanks, affecting the use of surface water as a natural resource.	Reversible	Medium Degree	Operational	6.3 ha	2	4	Medium	Control and prevention	1	2	Low

No.	Aspect affected	Alternatives	Activity	Potential Impact	Reversibility	Irreplaceable loss	Phase	Size and scale of disturbance	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
									Probability	Magnitude	Significance		Probability	Magnitude	Significance
			Operation of servitude and haul roads	As part of the proposed SWEP Phase 2 project a servitude road will be constructed west of the WWRD 5. This road will extend from the top of the product stockpile to the bottom of the topsoil stockpile. Multiple haul roads will also be constructed to gain access to the WWRD 5. If left unmitigated, surface water will pond against the servitude road as its runoff drains in a westerly direction towards the Gamagara River, resulting in a reduction of surface water quantity. Several haul roads will also be constructed as part of the proposed SWEP Phase 2 project, which could be disrupted and further prevented from reaching downstream areas. Additionally, the road surfaces will be heavily compacted, resulting in impermeable areas where runoff volumes and velocities will increase during rainfall events. This increase in runoff volumes and runoff speed could result in erosion, particularly at concentration points along the roads. Surface water quality: Deterioration of surface water quality due to increased erosion and sedimentation. Surface water quantity: There will be a decrease in clean water runoff reporting to the downstream catchment if runoff is left to pond against the servitude/haul roads, potentially reducing the availability of water to downstream users.	Reversible	Medium Degree	Operational	220 ha	3	2	Medium	Control and prevention	2	1	Low
5	Groundwater	Alternatives are not applicable in the construction phase	Construction of activities	The impacts on groundwater quality are primarily related to the management of materials, wastes and spills and unauthorised disposal of contaminated substances. Contamination of groundwater may also arise due to incorrect handling and disposal of waste materials. This risk is considered low. Due to the short exposure and small scale of these potential spills, the impacts will be negligible during the construction phase. Except for the lesser oil and diesel spills, there are no activities expected that could impact on regional groundwater quality. This phase should thus cause very little additional impacts. It is expected that the current status quo will be maintained. A very limited groundwater quality impact is expected during the construction phase, generally because of the small surface areas involved and the short duration thereof.	Reversible	Low Degree	Construction	750 ha	1	2	Low	Prevent or contain groundwater contamination	1	1	Low
		Impact from WWRD 5 alternative 1 & 2 and haul roads alternative 1 & 2)	Operational phase of activities	A change in recharge patterns is expected from the altered environment/s. Less recharge is expected over compacted haul roads and cleared areas while in contrast greater recharge is expected in the waste rock dump and the aquifer underlying it. However, on a regional scale the changes are expected to be insignificant and no changes in the groundwater levels or flow directions are expected.	-	-	Operational Phase	-	-	-	Insignificant	No mitigation required	-	-	NA

No.	Aspect affected	Alternatives	Activity	Potential Impact	Reversibility	Irreplaceable loss	Phase	Size and scale of disturbance	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
									Probability	Magnitude	Significance		Probability	Magnitude	Significance
				Poor quality leachate generation that will impact aquifers underlying the operations associated with the application activities. No sulphidic minerals are present in the waste rock that could result in acidity of drainage or mine water and ABA tests confirmed that no acid potential exists. The waste rock is a low risk waste with no acid generating capacity. It is a relatively inert material with little pollution potential. TDS of the waste rock leachate will be dominated by HCO3, Cl, Na and Ca and possibly nitrogen but will be well within drinking water standards. The plume/s will be localised to the footprint and little migration is expected due to the low recharge and low hydraulic properties of the aquifer. Leachate quality will remain within drinking water standards with a TDS of ~300 mg/l and will be limited to the shallow aquifer.	Reversible	Low Degree	Operational Phase	-	3	1	Low	Prevent or contain groundwater contamination	2	1	Low
		Alternative 3 (impact from backfilling waste rock)	Operational phase of activities	Poor quality leachate generation that will impact aquifers underlying the operations associated with the application activities. An alternative to storage on surface is in-pit-dumping whereby the WRD is directly tipped into mined out areas of the pit. This reduces dump footprint and decreases closure liability. The open pit will remain after mine closure, and it is assumed that only a portion of the pit will be backfilled. Backfilling the Western WRD into the mine pit will have no negative impacts on groundwater. This is due to the insignificant volume of material compared to the void volume and no groundwater (or pollutants) will migrate outwards from the pit due to the hydraulic gradient that is formed between pit heads and ambient heads. The pit will remain a sink even after closure if partially backfilled.	Reversible	Low Degree	Operational Phase	-	2	1	Low	Prevent or contain groundwater contamination	1	1	Low
6	Biodiversity	Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Clearing of vegetation from low to moderate sensitivity areas.	The transformation of extensive natural areas reduces landscape connectivity and loss of ecosystem functioning and services. Loss of protected flora specimens due to clearing of areas for development, which includes protected and endemic species. These areas are of value as they serve as links to allow the migration of fauna and flora between areas on an ecosystem scale.	Irreversible	Medium Degree	Site clearance	455 ha	3	3	Medium	Modify, Remedy	2	3	Medium
		Waste rock dump and haul road Alternative 2						478 ha							
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Clearing of vegetation from high sensitivity areas (Alternative 01/ Alternative 02)	Moderately sensitive areas such as *Boscia albitrunca* associated grasslands are less represented while providing more significant ecological and diversity functioning. Loss of protected flora specimens due to clearing of areas for development, which includes protected and locally endemic species. These areas are of value as they serve as links to allow the migration of flora between areas on an ecosystem scale.	Irreversible	High Degree	Site clearance	74 ha	3	4	High	Modify, Remedy	3	3	Medium
		Waste rock dump and haul road Alternative 2	Clearing of vegetation from high sensitivity areas.												

No.	Aspect affected	Alternatives	Activity	Potential Impact	Reversibility	Irreplaceable loss	Phase	Size and scale of disturbance	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
									Probability	Magnitude	Significance		Probability	Magnitude	Significance
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Clearing of soil from low to high sensitivity areas.	Loss of topsoil, seedbank, microbial resources through physical disturbance. Soil resources are disturbed by means of removal and compaction, as well as polluted due to accidental spills and leaks.	Irreversible	Medium Degree	Site clearance	528 ha	3	4	High	Remedy, Control	2	2	Low
		Waste rock dump and haul road Alternative 2						551 ha							
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Loss of sensitive habitat surroundings.	Loss of the habitat qualities present in the wetland catchment areas.	Irreversible	High Degree	Site clearance	0 ha	3	3	Medium	Control	2	3	Medium
		Waste rock dump and haul road Alternative 2						2 ha							
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Loss of soil functionality due to storage of soil.	Loss of topsoil resources' functionality due to leaching and loss of seedbank as part of long-term storage.	Irreversible	High Degree	Site clearance	150 ha	3	3	Medium	Control	2	2	Low
		Waste rock dump and haul road Alternative 2			Reversible	Low degree		0 ha	2	2	Low		2	2	Low
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Construction & Operation Phase: Earth Works; Operational dust deposition in sensitive habitats.	Air pollution sources on site include land clearing activities, materials handling, wind erosion from disturbed areas and/or stockpiles, dust generated by vehicular movement along unpaved roads, and emissions from machinery and vehicles on site. Air pollution from operational activities such as transportation of waste.	Irreversible	High Degree	Site clearance; and construction	>1150 ha	4	4	High	Control	3	3	Medium
		Waste rock dump and haul road Alternative 2													
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Increase in noise levels and disturbance.	Noise pollution can be measured as noise disturbance and/or cause noise nuisance, both of which will have different impacts on the receiving environment and receptors.	Reversible	Low degree	Site clearance; construction; and operational	>1150 ha	2	2	Low	Control	2	2	Low
		Waste rock dump and haul road Alternative 2													
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Surface water contamination (wetlands).	Mining related developments generally present numerous pollution sources that can negatively impact the surface water quality during all project phases. Some of the pollution sources on site include fuel and lubricants, and residues from ore	Reversible	Low degree	Construction; and operational	245 ha	3	3	Medium	Remedy, control	3	3	Medium

No.	Aspect affected	Alternatives	Activity	Potential Impact	Reversibility	Irreplaceable loss	Phase	Size and scale of disturbance	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
									Probability	Magnitude	Significance		Probability	Magnitude	Significance
		Waste rock dump and haul road Alternative 2		stockpiles, waste rock dumps or tailings storage facilities.											
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Alteration of the natural drainage patterns in catchment areas.	Changes to the topography of the site will increase the amount of run-off from site as the waste rock dump has a higher surface area than flat plains. Natural drainage lines will also be altered and/or affected.	Reversible	Low degree	Site clearance; construction; operational; and closure	245 ha	3	3	Medium	Remedy, Control	3	3	Medium
		Waste rock dump and haul road Alternative 2													
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	WWRD 5 construction in grassland plains.	Large infrastructure such as WRDs will remain post closure as visual impacts, changing the sense of place of future land uses. The development will be located adjacent to existing WRD and should be absorbed by the existing infrastructure to some extent. The area is however located some distance (1,6 km from R325 and not visible from N14 National Road) from sensitive receptors and the site clearance and construction phases should have low visual impact.	Irreversible	High Degree	Operational; and closure	No defined area	2	2	Low	Modify	2	2	Low
		Waste rock dump and haul road Alternative 2													
		No alternatives are applicable to the silos.	Silos (Ammonium Nitrate)	Clearance of additional areas for construction purposes, as will be undertaken on previously disturbed footprint.	Reversible	Low degree	Operational	0.5 ha	2	2	Low	Avoid	1	1	Low
7	Sites of Archaeological and Cultural Importance	Waste rock dump and haul alternatives	SWEP Phase 2	For all project phases: No impact to sites of archaeological and cultural importance will occur as a result of the proposed SWEP Phase 2.											
8	Palaeontological	Waste rock dump and haul alternatives	Western Expansion Project of the Western Waste Rock Dump.	Construction activities may disturb or destroy fossils or bedrock of paleontological sensitivity.	Reversible	Low degree	Construction	750 ha	2	2	Low	Control	2	4	Low
9	Sensitive landscapes (wetlands)	Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Clearing of vegetation from wetland catchment areas.	Loss of protected and/or indigenous flora specimens due to clearing of areas for development, which also includes protected and endemic species. The transformation of sensitive habitats is the main threat of the continuation of these habitats and species dependent on them.	Irreversible	Medium degree	Site clearance	43 ha	3	3	Medium	Modify, Remedy	2	3	Medium
		Waste rock dump and haul road Alternative 2						67 ha	3	3	Medium		2	3	Medium
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Clearing of soil from wetland area buffers	Loss of topsoil, seedbank, microbial resources through physical disturbance. Soil resources are disturbed by means of removal and compaction, as well as polluted due to accidental spills and leaks.	Irreversible	High degree	Site clearance	43 ha	3	3	Medium	Remedy, Control	2	2	Low

No.	Aspect affected	Alternatives	Activity	Potential Impact	Reversibility	Irreplaceable loss	Phase	Size and scale of disturbance	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
									Probability	Magnitude	Significance		Probability	Magnitude	Significance
		Waste rock dump and haul road Alternative 2	Clearing of vegetation from wetland SSNF05	Loss of unique protected, endemic and/or indigenous flora specimens due to clearing of wetland SSNF05 for development. The transformation of sensitive habitats is the main threat of the continuation of these habitats and species dependent on them.	Irreversible	High degree	Site clearance	2 ha	3	3	Medium	Modify, Remedy	2	3	Medium
			Clearing of soil from wetland area buffers	Loss of topsoil, seedbank, microbial resources through physical disturbance. Soil resources are disturbed by means of removal and compaction, as well as polluted due to accidental spills and leaks.	Irreversible	Medium degree	Site clearance	67 ha	3	3	Medium	Remedy, Control	2	2	Low
			Clearing of soil from wetland SSNF05		Irreversible	High degree	Site clearance	2 ha	3	3	Medium	Stop	2	2	Low
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Loss of sensitive habitats	Loss of the habitat qualities present in the wetland catchment areas.	Irreversible	High degree	Site clearance	43 ha	3	3	Medium	Control	2	3	Medium
		Waste rock dump and haul road Alternative 2	Loss of sensitive habitat surroundings					76 ha							
			Loss of sensitive habitat SSNF05.	Loss of the unique habitat offered by wetland SSNF05.	Irreversible	High degree	Site clearance	2 ha	3	3	Medium	Stop	1	2	Low
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Construction & Operation Phase: Earth Works; Operational dust deposition in sensitive habitats.	Air pollution sources on site include land clearing activities, materials handling, wind erosion from disturbed areas and/or stockpiles, dust generated by vehicular movement along unpaved roads, and emissions from machinery and vehicles on site. Air pollution from operational activities such as transportation of waste.	Irreversible	High degree	Site clearance and construction	>1150 ha	4	4	High	Control	3	3	Medium
		Waste rock dump and haul road Alternative 2													
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Increase in noise levels and disturbance.	Noise pollution can be measured as noise disturbance and/or cause noise nuisance, both of which will have different impacts on the receiving environment and receptors.	Reversible	Medium degree	Site clearance, construction, and operational	>1150 ha	2	2	Low	Control	2	2	Low
		Waste rock dump and haul road Alternative 2													
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Surface water contamination by means of e.g., hydrocarbon pollution in wetlands.	Mining related developments generally present numerous pollution sources that can negatively impact the surface water quality during all project phases. Some of the pollution sources on site include fuel and lubricants; and residues from ore stockpiles, waste rock dumps or tailings storage facilities.	Reversible	Medium degree	Construction and operational	43 ha	3	3	Medium	Remedy, Control	3	3	Medium
		Waste rock dump and haul road Alternative 2						67 ha							
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Alteration of the natural drainage patterns.	Changes to the topography of the site will increase the amount of run-off from site as the WRD has a higher surface area than flat plains. Natural drainage lines will also be altered and/or affected.	Reversible	Low degree	Site clearance, construction, operational and closure	<1150 ha	3	3	Medium	Remedy, Control	2	2	Low

No.	Aspect affected	Alternatives	Activity	Potential Impact	Reversibility	Irreplaceable loss	Phase	Size and scale of disturbance	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
									Probability	Magnitude	Significance		Probability	Magnitude	Significance
		Waste rock dump and haul road Alternative 2													
10	Air quality	Waste rock dump and haul alternatives	Windblown dust from waste dumps, haul roads and screening.	Impact on the ambient air quality.	Partially reversible	High degree	Operational	751 ha	3	4	High	Control through mine planning	3	3	Medium
		No alternatives are applicable to the silos.	Silos (Ammonium Nitrate)	Risk of fires from storage of ammonium nitrate.	Partially reversible	High degree	Operational	0.5 ha	4	3	High	Remedy, Control	3	3	Medium
11	Noise	Various construction and operational activities – WWRD 5 Alternative 1 with Haul Rd Alternative 1	Construction and operational activities associated with the Western WRD and haul road.	The activities may raise ambient sound levels at the identified receptors to such an extent that the noise can be considered disturbing.	Reversible	Low degree	Construction and operational	Up to 42 dBA	2	3	Low	None required	2	3	Low
		Various construction and operational activities – WWRD 5 Alternative 2 with Haul Rd Alternative 1			Reversible	Low degree	Construction and operational	Up to 44 dBA	2	3	Low		2	3	Low
		Various construction and operational activities – WWRD 5 Alternative 1 with Haul Rd Alternative 2			Reversible	High degree	Construction and operational	Up to 45 dBA	5	3	High	Control	2	3	Low
		Various construction and operational activities – WWRD 5 Alternative 2 with Haul Rd Alternative 2			Reversible	High degree	Construction and operational	Up to 45 dBA	5	3	High		2	3	Low
12	Visual	Waste rock dump and haul alternatives	Site clearing of the project footprint areas associated with the proposed expansion area, including the stockpiles, Western Waste Rock Dump 5 (“WWRD 5”), haul roads, filling point etc.	Removal of vegetation leading to increased visual contrast, loss of Visual Absorption Capacity of the landscape and visual intrusion on sensitive receptors.	Partially reversible	High degree	Construction	Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors.	4	4	High	To keep development footprint area as small as possible in order to present unnecessary loss of vegetation, control through planning	3	3	Medium
				Alteration of natural features as a result of infrastructure placement and positioning, including potential loss or alterations natural vegetation, leading to loss of visual quality and visual exposure. Natural features act as visual resources and disturbance of such landscape features will also have an impact on landscape character and sense of place of the region.	Not reversible	High degree			4	5	High	To prevent loss of sensitive habitat feature that act as visual resources within the area and contribute to landscape character	3	3	Medium
			Construction of the WWRD 5, stockpiles, HME Parkup, rapid reload bay and filling points	Excavation during construction of proposed infrastructure will lead to visual intrusion and visual exposure.	Potentially reversible	Medium degree		Impacts are limited to the activity and its immediate surroundings (tens of metres)	3	3	Medium	To minimise the visual impact from excavations	3	1	Low

No.	Aspect affected	Alternatives	Activity	Potential Impact	Reversibility	Irreplaceable loss	Phase	Size and scale of disturbance	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
									Probability	Magnitude	Significance		Probability	Magnitude	Significance
				Topographical alteration as a result of construction activities such as the WWRD 5 that will be silhouetted in the skyline, leading to a change in the natural environment which will lead to increased level of visual intrusion and a potential impact on sense of place of the region.	Not reversible	High degree		Impact on local scale/ adjacent sites (km's). Alterations to the topography of the landscape is likely to be visible for significant distances.	4	5	High	To minimise construction activities and impacts from a project layout that will lead to high levels of topographical alteration	4	3	High
			Dumping of waste material at the WWRD 5 and stockpiles.	Continual dumping of material and increasing heights of the WWRD 5 and stockpiles during operational activities.	Not reversible	High degree	Operational	Impact on local scale/ adjacent sites (km's). WWRD 5 and stockpiles of significant vertical heights are likely to be visible over significant distances.	4	4	High	To limit visual impacts as a result of dumping of material at the WWRD 5 and stockpiles	3	3	Medium
			Dust generation especially on a windy day from dumping of waste material on the WWRD 5 and stockpiles.	Mine vehicles driving on haul roads and dumping of waste material on a windy day could lead to temporary atmospheric haziness, which is likely to lead to visual impacts on adjacent receptors.				Impact on local scale/ adjacent sites (hundreds of meters). Due to the conveyor being of a relatively low height, it is not expected to be highly visible.	3	3	Medium	To limit impacts on the visual environment from haziness caused by dust	3	1	Low
			Night time lighting associated with the proposed HME Parkup, rapid reload bay and filling points	Night time lighting due to 24 hour operations of the HME Parkup, filling points and rapid reload bay, potentially impacting on receptors.	Reversible	Medium degree	Operational	Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors.	3	2	Medium	To limit visual impacts from night time lighting	2		Low
			Demolition of all surface infrastructure	Removal of infrastructure and general decommissioning and closure activities leading to visual intrusion on sensitive receptors.	Potentially reversible	Medium degree	Decommissioning and closure	Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors.	3	3	Medium	To limit visual impacts as a result of mine surface infrastructure decommissioning	3	2	Medium
			Rehabilitation activities	Ineffective rehabilitation leading to landscape scarring, permanent visual contrast and a permanent alteration of the landscape character and sense of place within the region.				Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors.	3	3	Medium	To ensure that effective rehabilitation takes place in such a way as to prevent permanent visual impacts remaining post-closure	3	3	Medium
13	Socio-economic	Waste rock dump and haul alternatives	Construction of the proposed SWEP Phase 2 project.	Jobs will be retained, and additional jobs created providing income and, therefore, having a further positive impact on the regional socio-economy aspects of the area, along with other benefits arising from the Social and Labour Plan.	Reversible	Low degree	Construction and operational	Local and regional	Positive impact			Control	Positive impact		

Table 10: Identified cumulative impacts

Environmental component (Aspects affected)	Potential Impact description
Biodiversity	Evidence of several protected fauna and herpetofauna were observed. Relatively high fauna activity occurred around the sensitive habitats (wetlands), especially at the tailings storage facility incorporated as cumulative impacts. Cumulative impacts associated with the development are a concern given the extensive loss of ephemeral pans to date and the fact that theJohn Taolo Gaetsewe district has extensive mining and solar developments destroying, isolating, and fragmenting wetland networks and *Vachellia erioloba* woodlands. The loss of habitat for this project is however diminished because of the existing impacts on the site and the extensive representation of the vegetation type in the region.
Air quality	According to the *Air Quality Impact Assessment for the Sishen Western Expansion Project: Phase 2, a*lthough the proposed SWEP Phase 2 has a MEDIUM significance ranking, the current cumulative significance ranking remains HIGH, thus the mine needs to implement additional mitigation measures to reduce impacts to a moderate or low significance ranking.
Sensitive landscapes (wetlands)	Habitat fragmentation from mining activities has a cumulative impact on the connected wetland system to the north of the project area (SSNF01-02). Mining activities will further have an impact on the groundwater (recharged via pan networks) and surface water quality. Many of these wetland habitats have already been destroyed by mining activities and will continue to be impacted by the mine's development. Current mining and solar plant developments exacerbate the cumulative impacts on pan networks in the area.
Visual	Cumulative visual impacts resulting from landscape modifications as a result of the proposed expansion activities are of low significance, due to existing mining activities within the area (Sishen Iron Ore Mine, Mamatwan, Tshipi Mine, Kumba Iron Ore Mine) as well as the area being within the Gamagara Corridor which is the mining belt of the John Taolo Gaetsewe and Siyanda districts. Since the proposed expansion area is situated within the mining belt, the cumulative impact thereof is not considered significant, as the sparse receptors within the area are accustomed to mining activities. These receptors include mine workers, farmers, contract workers and occasional tourists passing through the area. The sense of place might however be affected due to the bulk appearance of the mining dumps being increased. Cumulative visual impacts resulting from the night-time lighting associated with the existing mines in the area as well as from the towns (Kuruman, Hotazel, and Kathu) are considered of low significance due to the distance.
Geohydrological	During the operational phase, pit dewatering can increase the hydraulic head between the WRD and pit, which will in turn result in the plume migrating towards the pit rather than towards the west and the ambient groundwater flow conditions. The shallow aquifer was 'dewatered' by inserting a drain in the model on the weathered aquifer, but it showed to be of no significance.
Socio-Economic	Jobs will be retained, providing income and, therefore, having a further impact on the regional socio-economy aspects of the area.

7.6 Methodology used in determining and ranking potential environmental impacts and risks

7.6.1 Methodology to be applied during the EIA and EMPr phase

The environmental risk of any aspect is determined by a combination of parameters associated with the impact. Each parameter connects the physical characteristics of an impact to a quantifiable value to rate the environmental risk.

Impact assessments should be conducted based on a methodology that includes the following:

- Clear processes for impact identification, predication and evaluation.
- Specification of the impact identification techniques.
- Criteria to evaluate the significance of impacts.
- Design of mitigation measures to lessen impacts.
- Definition of the different types of impacts (indirect, direct or cumulative).
- Specification of uncertainties.

After all impacts have been identified, the nature and scale of each impact can be predicted. The impact prediction will take into account physical, biological, socio-economic and cultural information and will then estimate the likely parameters and characteristics of the impacts. The impact prediction will aim to provide a basis from which the significance of each impact can be determined, and appropriate mitigation measures can be developed. The risk assessment methodology is based on defining and understanding the three basic components of the risk, i.e. the source of the risk, the pathway and the target that experiences the risk (receptor). Refer to Figure 27 below for a model representing the above principle (as contained in the DWA's Best Practice Guideline: G4 – Impact Prediction).

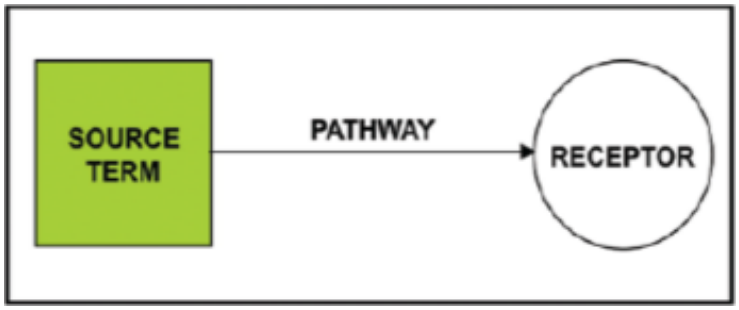

Figure 27: Impact prediction model

Table 11 and Table 13 below indicate the methodology to be used in order to assess the Probability and Magnitude of the impact, respectively, and provides the Risk Matrix that will be used to plot the Probability against the Magnitude in order to determine the Severity of the impact in Table 12.

Table 11: Determination of Probability of impact

Score	Frequency of Aspect / Unwanted Event	Availability of Pathway from the source to the receptor	Availability of Receptor
1	Never known to have happened, but may happen	A pathway to allow for the impact to occur is never available	The receptor is never available
2	Known to happen in industry	A pathway to allow for the impact to occur is almost never available	The receptor is almost never available
3	< once a year	A pathway to allow for the impact to occur is sometimes available	The receptor is sometimes available
4	Once per year to up to once per month	A pathway to allow for the impact to occur is almost always available	The receptor is almost always available
5	Once a month - Continuous	A pathway to allow for the impact to occur is always available	The receptor is always available

Step 1: Determine the PROBABILITY of the impact by calculating the average between the Frequency of the Aspect, the Availability of a pathway to the receptor and the availability of the receptor.

Table 12: Determination of Severity of impact

Environmental Impact Rating / Priority					
	MAGNITUDE				
Probability	**1 Minor**	**2 Low**	**3 Medium**	**4 High**	**5 Major**
5 Almost Certain	Low	Medium	High	High	High
4 Likely	Low	Medium	High	High	High
3 Possible	Low	Medium	Medium	High	High
2 Unlikely	Low	Low	Medium	Medium	High
1 Rare	Low	Low	Low	Medium	Medium

Step 3: Determine the SEVERITY of the impact by plotting the averages that were obtained above for Probability and Magnitude.

Table 13: Determination of Magnitude of impact

Score	Source					Receptor
	Duration of impact	Extent	Volume / Quantity / Intensity	Toxicity / Destruction Effect	Reversibility	Sensitivity of environmental component
1	Lasting days to a month	Effect limited to the site. (metres);	Very small quantities / volumes / intensity (e.g. < 50 ℓ or < 1 ha)	Non-toxic (e.g. water) / Very low potential to create damage or destruction to the environment	Bio-physical and/or social functions and/or processes will remain unaltered.	Current environmental component(s) are largely disturbed from the natural state.
2	Lasting 1 month to 1 year	Effect limited to the activity and its immediate surroundings. (tens of metres)	Small quantities / volumes / intensity (e.g. 50 ℓ to 210 ℓ or 1 ha to 5 ha)	Slightly toxic / Harmful (e.g. diluted brine) / Low potential to create damage or destruction to the environment	Bio-physical and/or social functions and/or processes might be negligibly altered or enhanced / Still reversible	Receptor of low significance / sensitivity
3	Lasting 1 – 5 years	Impacts on extended area beyond site boundary (hundreds of metres)	Moderate quantities / volumes / intensity (e.g. > 210 ℓ < 5000 ℓ or 5 – 8 ha)	Moderately toxic (e.g. slimes) Potential to create damage or destruction to the environment	Bio-physical and/or social functions and/or processes might be notably altered or enhanced / Partially reversible	Current environmental component(s) are moderately disturbed from the natural state.
4	Lasting 5 years to Life of Organisation	Impact on local scale / adjacent sites (km)	Very large quantities / volumes / intensity (e.g. 5000 ℓ – 10 000 ℓ or 8 ha– 12 ha)	Toxic (e.g. diesel & Sodium Hydroxide)	Bio-physical and/or social functions and/or processes might be considerably altered or enhanced / potentially irreversible	No environmentally sensitive components.
5	Beyond life of Organisation / Permanent impacts	Extends widely (nationally or globally)	Very large quantities / volumes / intensity (e.g. > 10 000 ℓ or > 12 ha)	Highly toxic (e.g. arsenic or TCE)	Bio-physical and/or social functions and/or processes might be severely/substantially altered or enhanced / Irreversible	Current environmental component(s) are a mix of disturbed and undisturbed areas.

Step 2: Determine the MAGNITUDE of the impact by calculating the average of the factors above.

7.7 Positive and negatives that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and community affected

The positive and negative implication of the SWEP Phase 2 and the alternative identified have been provided below and assessed in terms of the following four categories:

- Environmental.
- Technical/Engineering.
- Economical.
- Social.

Table 14: Advantage and disadvantages of the proposed activities and identified alternatives

Alternative	Advantages	Disadvantages
Location Alternative for the proposed Western Waste Rock Dump		
Location Alternative 1	**Environmental:** Smaller footprint size, and specialist concluded the favoured alternative. **Technical/Engineer:** An Estimated 137 million tonnes of incompetent waste rock material is expected from south mine pushbacks over the next business plan period (5 years). This alternative can accommodate the waste. **Economical:** Closure liability is lower than Alternative 2 as the volumes are less (193 558 937 cm^3). **Social:** Further distance to sensitive receptors than for Alternative 2	**Environmental:** Similar to Alternative 2, environmental impacts (as per various specialist assessments) will occur, including the requirement to obtain necessary permits and authorisations. Such also include DENC permits in terms of National Environmental Management: Biodiversity for the removal of nationally protected trees (*Vachellia erioloba* and *Boscia albitrunca).* **Economical:** Longer haul distance than in-pit dumping. **Social:** None identified.
Location Alternative 2	No advantages compared to Alternative 1 were identified.	**Environmental:** Similar impacts to Alternative 1 but also with larger footprint than Alternative 1 and located closer to the pan SSW01. **Economical:** Closure liability will be higher than for Alternative 1 as alternative 2 volume is (245 800 660.1 m^3). **Social:** Situated closer to sensitive receptors (farmers).
Location Alternative for the proposed haul roads		
Location Alternative 1	**Environmental:** No destruction of pan SSNF05 (as opposed to Alternative 2) **Technical/Engineer:** Less on and offramps compared to the dual haul road (Alternative 2). **Economical:** Single haul road is more economical to construct and requires less time for construction and maintenance is lower.	**Social:** Single haul road could be more dangerous as traffic in both directions has to be accommodated.
Location Alternative 2	**Technical/Engineer:** More entry points proposed into the pit.	**Environmental:** Complete destruction of pan SSNF05. More vegetation clearance is required.

Alternative	Advantages	Disadvantages
	Social: Less dangerous as haulage is designated to a separate lane to be used in both directions.	**Economical:** More expensive to construct a dual haul road. **Social:** Situated closer to sensitive receptors such as the Caravan Park.
Alternatives for waste rock disposal – Waste rock dumps		
Waste rock dumps	**Environmental:** Surface water runoff will not be lost to the pit. There will be no impact on wetlands due to the proximity of the wetlands to the WRD. In terms of geohydrology there will be greater recharge in the waste rock dump and the aquifer underlying it. The expansion of the WRD (2.3 million cm^3) is an extension to the approved WRD (34.4 million cm^3). This expansion amounts to 7.7 %. This is a small percentage. **Technical/Engineering:** The geometry of the dump design lends itself to flexibility to accommodate incompetent waste material (average 23 million tonnes per annum from south mine pushbacks). **Economical:** There are no alternative in-pit dumps available over the next 5 years in south or north mine. Hence the need for the WRD expansion to be approved. If the WRD expansion is not approved, waste rock will need to be hauled to the north mine WWRD, resulting in 11 km one-way haul versus the current 4 km to the WRD expansion. **Social:** WRD will need to be rehabilitated after LOM will create employment opportunities.	**Environmental:** Surface water impacts will be increased sedimentation due to the elevation of the WRD which will lead to erosion and impact the surface water quality. In terms of biodiversity there will be loss of vegetation due to clearance of vegetation. Permits will be required that include DENC permits in terms of National Environmental Management: Biodiversity for the removal of nationally protected trees (*Vachellia erioloba* and *Boscia albitrunca*). In terms of geohydrology there will be a change in recharge patterns expected from the altered environment/s. **Technical/Engineering:** there is no disadvantage for the WRD. **Economical:** Costs associated with the rehabilitation of the WRD expansion. **Social: T**here are no disadvantages.
In-pit dumping	**Environmental:** The impact on surface water will be reduced due to less sedimentation, and erosion. This will decrease the impacts on surface water quality. In terms of biodiversity there is no need to clear vegetation for in-pit dumping. There will be no impact on wetlands due to the proximity of the wetlands to the pit. In terms of geohydrology in-pit dumping the waste rock into the mine pit will have no negative impacts on groundwater. This is due to the insignificant volume of material compared to the void volume and no groundwater (or pollutants) will migrate outwards from the pit due to the hydraulic gradient that is formed between pit heads and ambient heads. The pit will remain a sink even after closure if partially backfilled.	**Environmental:** Surface water impacts will be the loss of runoff water lost to the pit. There are no disadvantages on biodiversity. There will be no impacts on the wetlands due to location of the wetlands. Geohydrology will have no negative impacts as the impacts are low. Additional dust generation if waste rock material is transported to north mine (11 km). **Technical/Engineering:** Lack of space for in-pit filing over the next 5 years for south and north mine. Due to the incompetent material volumes to be accommodated this will lead to a shortage of dump capacity which will lead to the need for an additional WRD later. Hauling full loads down a gradient posing technical problems to the haul trucks.

Alternative	Advantages	Disadvantages
	Technical/Engineering: More space available for mining infrastructure. **Economical:** Less rehabilitation costs as less WRD will need to be rehabilitated. Reduced mining costs due to shorter haulage distances. **Social:** No social advantages.	Introduces safety risks (brake-overheating and or failure of run-away trucks). **Economical:** Upgrades to the haul trucks will be required to enable them to safely haul full loads on a decline (ramps). No alternative in-pit dumps are available over the next 5 years in south mine. The primary focus is to still do in-pit dumping which can be done after 5 years in south mine. Sterilisation of 113 678 431 tonnes of ore will occur in south mine. **Social:** Less employment opportunities due to less rehabilitation for in-pit dumping.
No go option		
No go	**Environmental:** Sensitive habitats will be retained, and no offsets will be required. **Technical/Engineering:** No additional infrastructure and resources required. **Economical:** None identified. **Social:** No further change in sense of place.	**Economical:** Threat to optimal execution of mining plan. Should the dump not be approved, waste rock needs to be hauled to north mine (refer to figure below), resulting in 11 km one-way haul versus the current 4 km to Western Waste Rock Dump 5, making the future expansions uneconomical, impacting the future sustainability of the pit. **Social:** Benefits arising from optimal mining of reserve will be lost (Current developments (+43 project and additional c grade ore mine this can expand the LOM by 3 years to 2035).

From review of the table above, alternative 1 for the waste rock dump is the preferred alternative in terms of project layout. The technical and social advantages of this alternative also make this the preferred alternative. In terms of the haul roads, alternative 1 is the preferred alternative in terms of project layout. The environmental, economic, and technical also make this the preferred alternative.

Due to the lack of space in south and north mine for in-pit filing this is not possible in the next 5 years. Therefore, the waste rock will need to be transported to the north mine WWRD is not economically feasible due to the haulage distance. The WRD expansion is the most economically feasible option from a technical/engineering and economic perspective.

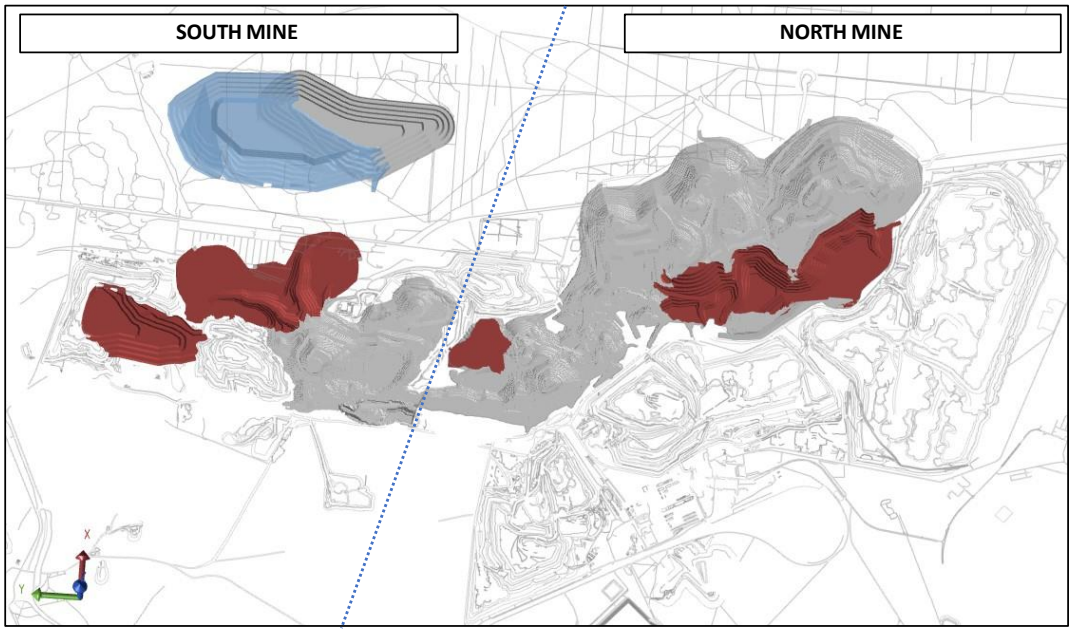

Figure 28: North and south mine at Sishen illustrating in-pit dumping and waste rock dump (approved and proposed expansion)

7.8 Possible mitigation measures that could be applied and the level of risk

The level of risks identified has been included under Section 7.5.1 of Part A and impact management measures under Section 1.4 of Part B. The table below provides for a summary of the issues and concerns as raised by affected parties and an assessment of the mitigations or site layout alternatives available to accommodate or address their concerns, together with an assessment of the impacts or risks associated with the mitigation or alternatives considered.

Table 15: *Summary of issues and concerns raised by I&APs*

Concerns as raised by affected parties	Mitigation measures or site alternative
No concerns have been raised thus far with regards to project or layout aspects, for which additional alternatives considerations (to those already identified) are required. Refer to Table 7 for comments received as part of the Scoping Phase public participation process. For concerns identified as part of the EIAR/EMPr phase, such will be included in this table at finalisation of this report.	

7.9 Final site layout plan

The outcome of the final site selection is discussed in Section 13 of Part A and the final layout plan included in Section 11.2 of Part A. Refer to the figure below for the preferred alternative 1 layout.

8 Full description of the process undertaken to identify, assess and rank the impacts and risks

All impacts and risks as identified are contained within Section 7.5.1 of Part A. As further provided is an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures. The methodology applied in assessing and ranking the impacts and risks on the preferred site is described in Section 7.6.1 of Part A.

9 Assessment of each identified potentially significant impact and risk

Refer to the full risk assessment table provided in Section 7.5 of Part A above.

10 Summary of specialist reports

Specialist study	Recommendations of specialists	Reference to applicable section in report where specialist recommendation is included
Ecological assessment	All recommendations and mitigation / management measures contained in specialist reports contained in Annexure E have been included in Section 1.4 in Part B of this report.	Section 1.4 in Part B
Wetland assessment		
Stormwater management plan		
Geohydrological Study		
Air Quality Impact Assessment		
Phase 1 heritage assessment		
Visual Impact Assessment		
Noise assessment		
Desktop Palaeontological study		

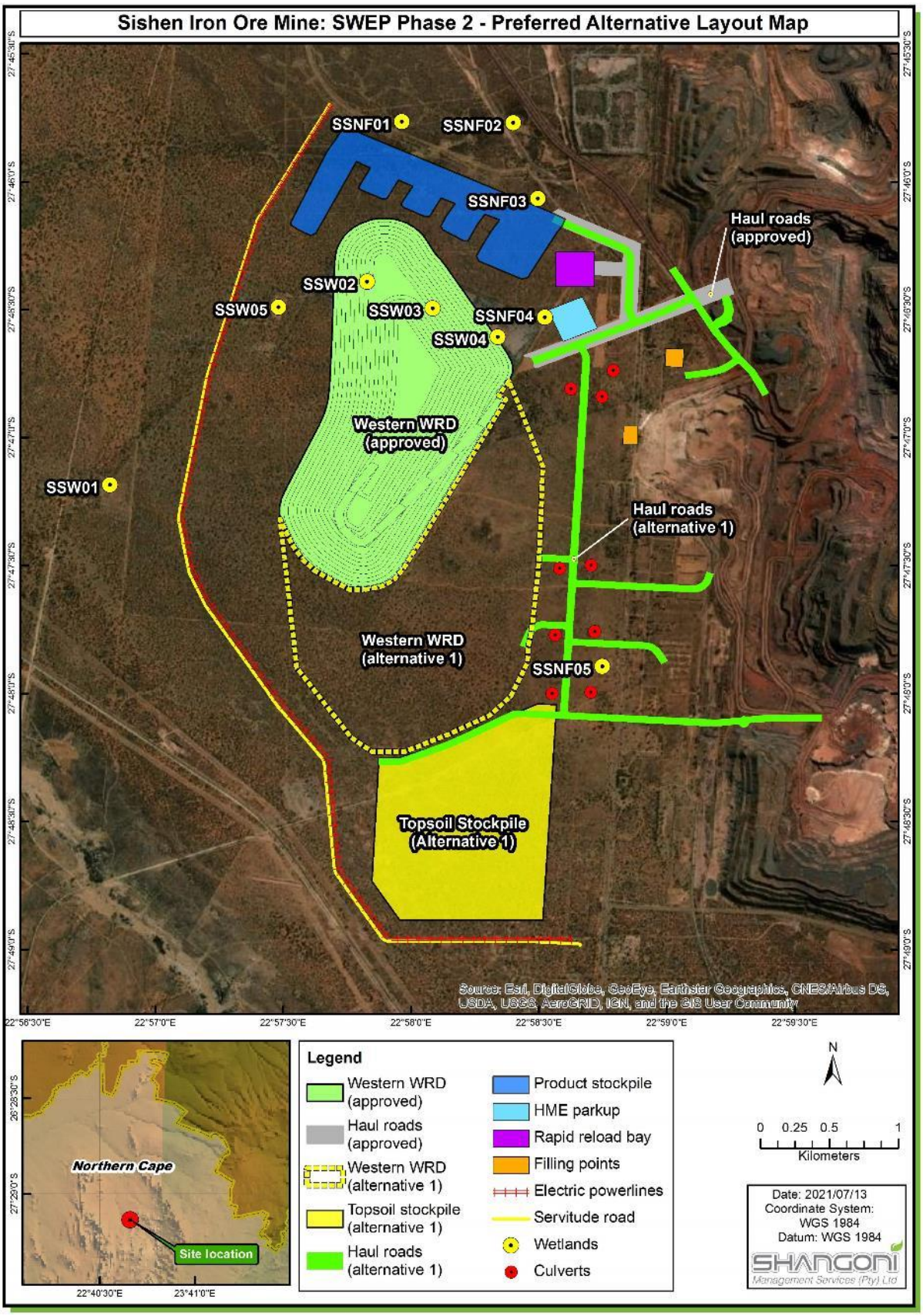

Figure 29: Final (preferred) layout

11 Environmental impact statement

11.1 Summary of the key findings of the environmental impact assessment

A summary of the high significant impacts (pre-mitigation) include: the clearing of vegetation from high sensitivity areas, clearing of soil from low to high sensitivity areas, the effect of mining activities on air quality, noise, and visual impacts. Mitigation and management measures for the predicted impacts are included in Part B of this EIAR/EMPr and need to be implemented by the applicant. The implementation of the mitigation measures will result in the minimisation of the significance of the potential impacts (post-mitigation). All high significance impacts pre-mitigation will be lowered to medium and low significance impacts post-mitigation, except for visual impacts as a result of topographical alteration associated with the WWRD 5.

11.2 Final site map

Refer to Figure 29 that illustrates the final site map of the project.

12 Proposed impact management outcomes for inclusion into the EMPr

Based on the assessment and where applicable the recommendations from specialist reports, the table below summarises the impact management outcomes for the proposed project for inclusion in the EMPr as well as for inclusion as conditions of authorisation.

Table 16: Impact management outcomes

Aspect affected	Impact management outcome	Standard to be achieved
Topography, soils, land use and land capability	Ensure minimum change in topography. Preserve sufficient soil volumes to enable pre-mining land capability post-rehabilitation.	Principles in the MPRDA, 2002, NEMA, 1998, NEM:WA, 2008, Regulations there under and amendments thereto. National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (GNR.331 of 2014), thereunder. Rehabilitation, decommissioning- and closure plan and closure objectives.
Biodiversity	Permits are required for destruction of protected flora and fauna. Limit development footprint according to the designs. Actively manage edge effects on surrounding natural habitat. Limit edge effects and alien plant proliferation. Implement dust suppression protocols where possible. Prevent any further disturbance to habitat considered sensitive or in a good ecological condition and ensure effective rehabilitation of disturbed areas. Develop an effective and ecologically suitable rehabilitation plan.	NEM:BA (2004) and the regulations thereunder. Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector. Environmental Conservation Act, 1989 (Act No 73 of 1989). National Forests Act, 1998 (Act No 84 of 1998). Northern Cape Nature Conservation Act, No. 9 of 2009. National Veld and Forest Fire Act, 1998 (Act No 101 of 1998). National Environmental Management: Protected Areas Act (NEM:PAA) (Act No 57 of 2003).
Surface water	To prevent erosion and siltation of watercourses. To prevent surface water quality deterioration.	National Water Act, 1998 and associated Regulations.

Aspect affected	Impact management outcome	Standard to be achieved
Groundwater	To minimise the extent of disturbance of the aquifer. To limit groundwater quality deterioration.	
Air quality	Prevent the deterioration of air quality.	National Environmental Management: Air Quality Act (Act No 39 of 2004); Regulations there under and amendments thereto. GG 36974, R827, National Dust Control Regulations, 1 November 2013.
Noise	Limit the generation of noise through the various activities to prevent the causing of any possible disturbance or discomfort of fauna or communities as a result.	Relevant sections of the National Environmental Management: Air Quality Act (Act No 39 of 2004); Regulations there under and amendments thereto. SABS Code of Practice 0103 of 2008: The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication. SABS Code of Practice 0328 of 2008: Environmental Noise Impact Assessments.
Sites of Archaeological and Cultural Importance	Conserve heritage resources.	National Heritage Resources Act (Act No. 25 of 1999), and amendments thereto.
Sensitive landscapes (wetlands)	Minimise the impact on sensitive landscapes.	National Water Act, 1998 and associated Regulations.
Visual	To limit visual impacts.	National Environmental Management Act (NEMA) (Act 107 of 1998). Advertising on Roads and Ribbons Act (Act 21 of 1940).
Socio-economic	To maximise economic opportunities for local employment and development.	Mineral and Petroleum Resources Development Act (MPRDA) (Act 28 of 2002). Social and Labour Plan.

13 Final proposed alternatives

Refer to Section 7.1 of Part A for the alternatives considered. Alternative 1 for the waste rock dump is the preferred alternative in terms of project layout and in terms of the haul roads alternative 1 is the preferred alternative in terms of project layout. The alternative 1 for the topsoil stockpile area is the only location alternative. Due to the lack of space in south and north mine, in-pit filing is not possible in the next 5 years. Therefore, the waste rock will need to be transported to the north mine WWRD which is not economically feasible due to the haulage distance. The WRD expansion is the most economically feasible option from a technical/engineering and economic perspective.

14 Description of any assumptions, uncertainties and gaps in knowledge

In terms of the EIA Regulations GN R982 Appendix 1(3)(o), the Environmental Impact Assessment Practitioner (“EAP”) must provide a description of any assumptions, uncertainties, and gaps in knowledge upon which the impact assessment has been based. The table below provides the assumptions and limitations applicable to the various specialist assessments.

Specialist study	Assumptions and limitations
Ecological Assessment	The initial site screening is not representative of all four seasons and was conducted before the rain season. All flora species could hence not be identified due to the lack of flowers and/or seeds. Furthermore, some annual species may have been absent during the time of assessment. Migratory bird species that inhabit this area in the summer had not yet returned from their migrations and would also have been overlooked. Faunal diversity is only based on visual sightings and/or evidence on-site and no long-term monitoring was conducted.

Specialist study	Assumptions and limitations
Geohydrological Assessment	It is important to note a few assumptions and limitations applicable to the numerical modelling exercise: • The numerical model is a very simplified representation or simulation of the actual situation. • Measured aquifer parameters are used to calibrate the numerical model and the level of confidence of model calculations is only as good as the information (accuracy, distribution, frequency etc.) on which it is based and the conceptual understanding of the geohydrology. • Model calibration was done in steady state. • The Model was simulated for the upper shallow aquifer only (saturated, horizontal confined aquifer).
Wetland Assessment	• Only a dry season site assessment was conducted, thus limiting the identification of possible important floral species onsite, limiting the observation of certain migratory avifauna; and limiting the observation of fauna species utilising the presence of water within these ephemeral pans. • No in-depth study was conducted to confirm important faunal or invertebrate species on-site. • No long-term observations were made to determine the hydrological regime of the wetlands (period of inundation and period of saturation). • Soil sampling and analysis are excluded. • Avi-fauna lists are excluded, and Invertebrate activation and species lists are excluded.
Visual Assessment	• No specific national legal requirements for Visual Impact Assessments (“VIAs”) currently exist in South Africa. However, the assessment of visual impacts is required by implication when the provisions of relevant acts governing environmental management are considered and when certain characteristics of either the receiving environment or the proposed SWEP Phase 2 indicate that visibility and aesthetics are likely to be significant issues and that visual input is required (Oberholzer, 2005). • Distance and terrain plays a critical role when assessing visual impacts of an area. Due to the relatively flat terrain of the expansion area and height of the proposed structures, it was deemed necessary to identify all potential sensitive receptors within a 10 km radius, on a desktop-level, which would then be verified during the field assessment. The 10 km radius can be considered the visual assessment zone. It should be noted that the visibility of an object decreases exponentially the further away the observer is from the source of impact. During the field assessment it was established that the bushveld vegetation limits the view of the observer to their immediate surroundings, not allowing one to see across the vistas. Consequently, it was deemed unnecessary to visit all potentially sensitive receptors within the visual assessment zone, thus focus was placed on visiting sensitive receptors within a 2 km radius. Several sensitive receptors situated further than 3 km were however visited to determine the level of visual intrusion on these receptors from the proposed expansion activities. • Due to a lack of guidelines for specialist visual impact assessments as part of the EIA process within the Northern Cape Province, the *Guidelines for Involving Visual and Aesthetic Specialists in the EIA Process* (Oberholzer, 2005), prepared for the Western Cape Department of Environmental Affairs & Development Planning, was used. • All information relating to the proposed SWEP Phase 2 as referred to in this report is assumed to be the latest available information. Additionally, best practice guidelines were taken into consideration and utilising the maximum expected heights of the infrastructure and the placement thereof in viewshed calculations as a precautionary approach. • Abstract or qualitative aspects of the environment and the intangible value of elements of visual and aesthetic significance are difficult to measure or quantify and as such depend to some degree on subjective judgments. It therefore is necessary to differentiate between aspects that involve a degree of subjective opinion and those that are more objective and quantifiable.
Noise Assessment	• Ambient sound levels are the cumulative effects of innumerable sounds generated at various instances both far and near. High measurements may not necessarily mean that noise levels in the area are high. Similarly, a low sound level measurement will not necessarily mean that the area is always quiet, as sound levels will vary over seasons, time of the day, faunal characteristics, vegetation in the area and meteorological conditions (especially wind). This is excluding the potential effect of sounds from anthropogenic origin. It is impossible to quantify and identify the numerous sources that influenced a measurement using the reading result at the end of the measurement. Therefore, trying to define ambient sound levels using the result of one 10-minute measurement can be inaccurate (very low confidence level in the results) for the reasons mentioned above. The more measurements that can be collected at a location the higher the confidence levels in the ambient sound level determined. The more complex the sound environment, the longer the required measurement. When singular measurements are used, a precautious stance must be adopted (this report only report long-term measurements collected over a 2-night period).

Specialist study	Assumptions and limitations
	• Ambient sound levels are dependent not only on time of day and meteorological conditions but also change due to seasonal differences. Ambient sound levels are generally higher in summer months when faunal activity is higher and lower during the winter due to reduced faunal activity. Winter months unfortunately also coincide with lower temperatures and very stable atmospheric conditions, ideal conditions for propagation of noise. Many faunal species are more active during warmer periods than colder periods. Certain cicada species can generate noise levels up to 120 dB for mating or distress purposes, sometimes singing in synchronisation magnifying noise levels they produce from their tymbals . • It is assumed that the measurement locations represent other residential dwellings in the area (similar environment), yet, in practice, this can be highly erroneous as there are numerous factors that can impact on ambient sound levels, including: o the distance to closest trees, number and type of trees as well as the height of trees. o distance to roads, construction material of the road, the traffic volumes on that road as well as the average speeds on this road. o available habitat and food for birds and other animals. o distance to residential dwelling, type of equipment used at dwelling (compressors, air-con). o general maintenance condition of house (especially during windy conditions). o number and type of animals kept in the vicinity of the measurement locations (typical land use taking place around the dwelling). • Measurements over wind speeds of 3 -5 m/s could provide data influenced by wind-induced noises. • Ambient sound levels recorded near rivers, streams, wetlands, trees and bushy areas can be high due to faunal activity, which can dominate the sound levels around the measurement point (specifically during summertime, rainfall event or during the dawn chorus of bird songs). This generally is still considered naturally quiet and accepted as features of the natural baseline, and in various cases sought after and pleasing. Using this data to define the ambient sound level will result in a higher rating level, and data collected close to such measurement locations will not be considered. • Considering one or more sound descriptor or equivalent can improve an acoustical assessment. Parameters such as LAMin, LAeq, LAMax, LA10, LA90 and spectral analysis forms part of the many variables that can be considered. However, South African legislation requires consideration of the impulse-weighted LAeq setting that will be considered when measuring ambient sound levels. • Exact location of a sound level meter in an area in relation to structures, infrastructure, vegetation, wetlands and external noise sources will influence measurements. It may determine whether you are measuring anthropogenic sounds from a receptors dwelling, or measuring environmental ambient baseline contributors of significance (faunal, roads traffic, railway traffic movement etc.). • As a residential area develops, the presence of people will result in increased dwelling-related sounds. These are generally a combination of traffic noises, voices, animals and equipment (including TVs and radios). The result is that ambient sound levels will increase as an area matures.
Air quality	• The quantification of sources of emission was restricted to additional emissions that would be generated by the proposed SWEP project. • Project information required to calculate emissions for operations were provided by Shangoni Management Services (Pty) Ltd. Where necessary, assumptions were made based on the specialist's experience. These are stated in more detail in the emissions inventory section. • Dispersion modelling was only done for alternative 1, with a qualitative discussion for alternative 2.
Stormwater management plan	• Upstream catchment activities are interpreted according to common practices and no detailed insight is available on possible storm water measures beyond the site. The assessment does not guarantee the integrity of downstream infrastructure in the event of release or discharge from site. • It was assumed that the preferred alternatives (i.e., alternative 1) for the Western Waste Rock Dump 5, topsoil stockpile and haul roads are the recommended go-forward options to be constructed. The SWMP and associated mitigation measures where therefore specifically designed for the preferred alternatives. • The measures proposed as part of the storm water management section of the report do not impose preference as this is an operational document to assist in the complete management of clean and affected surface water in the vicinity of the operation. • The measures proposed in the storm water management plan section of the report do not specifically cover considerations relevant to storm water management for the purpose of safety, like mine flooding and loss of life; the primary focus being environmental management and the identification of potential environmental concerns.

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

15.1 Reasons why the activity should be authorised or not

In terms of collectively considering ecological, social, and economic impacts it is important to remember that while there might be some trade-offs between the considerations, in South Africa all development must in terms of Section 24 of the Constitution be ecologically sustainable, while economic and social development must be justifiable. There are, therefore, specific "trade-off" rules that apply. Environmental integrity may never be compromised, and the social and economic development must take a certain form and meet certain specific objectives for it to be considered justifiable[4].

From all specialists' opinions, the impacts can be mitigated too medium to low. The only impact that remains high after mitigation is the visual impact. However, based on the impact assessment, it is evident that the proposed expansion area activities have a moderately low visual impact on the surrounding environment. This is mainly attributed to the sparse sensitive receptors within a 4 km radius as well as the existing waste rock dumps forming part of the skyline and the bushveld vegetation limiting the view. Additionally, the proposed expansion area is situated within the mining belt of the Northern Cape, thus it is in keeping with the land use and sense of place of the area. The proposed expansion area activities will increase the bulk appearance of the already existing mine dumps. Since the proposed WWRD 5 and stockpiles do not have any fixed lighting associated with it, except for the light associated with the trucks, the visual impact on the receiving environment in terms of lighting pollution will be negligible. The HME Parkup, rapid reload bay and filling points are situated in-between the existing and proposed waste rock dumps; the contribution to light pollution is minimal. The project is considered acceptable from a visual resource management perspective, provided that the mitigatory measures as outlined in the report are implemented and adhered to.

The EAP is of opinion that the project should be authorised.

15.2 Conditions that must be included in the authorisation

15.2.1 Specific conditions to be included into the compilation and approval of the EMPr

Should the DMRE grant authorisation for SIOM, it should be subject to the following conditions:

- No vegetation clearance may be allowed to commence prior to obtaining the necessary permits and clearly demarcating all areas to be cleared. The ECO responsible for environmental compliance on site should further be allowed to implement any additional measures he/she deems necessary and the associated necessary training (e.g. ecological, hydrocarbon management etc.) should be incorporated into the contractors' induction.
- Ongoing development and implementation of dust management programme.

[4] Guideline on need and desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 (GN 891 of 20 October 2014)

- Limiting exposed areas throughout all stages of mine operations.
- Work in rivers, streams and wetlands should preferably be done during the low flow season to minimise fauna impact since fauna activity increase during the wet season.
- All wetlands affected by the project should be inspected regularly for sedimentation and erosion.
- Implementation of the necessary storm water management measures to avoid discharge or seepage of affected water into the natural surface water environment.
- Status quo groundwater monitoring should continue to include quality and water level monitoring with regular interpretation of results by a qualified and professional geohydrologist.
- Monitoring and management of the natural surface water environment should also receive priority. Degradation of these natural systems should be avoided.
- Decommissioning of the facilities should entail final rehabilitation, i.e., re-shaping to enhance free drainage / surface run-off, top soiling and seeding.

16 Period for which Environmental Authorisation is required

The remaining life of mine is currently estimated to be at least until 2032. The period for which the environmental authorisation is required is 11 years.

17 Undertaking

The undertaking by the EAP is provided in Section 2 of Part B below. This undertaking confirms: the correctness of the information provided in the reports, the inclusion of comments and inputs from stakeholders and I&APs, the inclusion of inputs and recommendations from the specialist reports where relevant and the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

18 Financial provisions

18.1 Explain how the aforesaid amount was derived

The closure liability was calculated in line with the promulgated Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations (GN No. R. 1147, 20 November 2015) in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998). A database was compiled, containing each structure and disturbed area. The liability was calculated per line item based on the area measured / volume obtained and multiplied with the applicable contractor rate.

The calculation was split per the alternatives for SWEP Phase 2:

- Alternative 1 layout;
- Alternative 2 layout;
- Alternative 1 in-pit filling; and

- Alternative 2 in-pit filling

The closure liability consists of the following categories:

- Physical - Demolition of infrastructure where infrastructure does not form part of end land use,
- Biophysical - Actions to safeguard (making safe and stable) and re-establish the biophysical to ensure a sustainable landform and mitigate identified risks. This includes ripping disturbed areas and seeding some of the ripped areas (where vegetation could not establish naturally), and
- Post closure management – Actions required as part of aftercare after the mine has been closed.

The liability for the different alternatives, including contingency (10%), P&Gs (20%) and excluding VAT is:

- Alternative 1 layout R356,576,939.39;
- Alternative 2 layout R548,317,816.59.

In terms of in-pit filling of WRD alternative 1 and 2 which is an estimated 292,428,184.36 tonnes of material it is estimated to cost a minimum of R10,234,986,452.61.

Refer to the table below for the calculations discussed above.

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

SIOC uses bank guarantees. Once the project is approved and a condition is issued by the DMRE to make the provision then SIOC will apply for the new guarantee.

19 Deviations from the approved scoping report and plan of study

No deviations from the approved scoping report and plan of study have been undertaken except for the Palaeontological study that was requested for by the South African Heritage Resources Agency that was conducted, and additional alternatives were identified during the EIA phase.

Table 17: Financial provisions calculations for SWEP Phase 2

Classification	Alternative	Area	Description	Rate category	Quantity	Unit	Number / other/ factor	Total Size	Rates	Alternative 1 total	Alternative 2 total	Notes
Physical	Both	Screening plant	Removal of screening plant - contractor obligation	No cost incurred	0.00	n/a	1.00	0.00	R0.00	R0.00	R0.00	Assumption - the screening plant will be mobile and will be removed by the responsible contractor
Physical	Both	Rapid reload	New fence	Dismantling fences 2.1m Security	584.00	m	1.00	584.00	R110.00	R64,240.00	R64,240.00	
Physical	Both	Rapid reload	New water lines	Infrastructure: Pipelines <400mm	1,659.00	m	1.00	1,659.00	R42.08	R69,810.72	R69,810.72	Assumption - lines earmarked for relocation (see assumptions sheet) are in the existing liability and excluded from this calculation
Physical	Both	General	New 66kV power line	Infrastructure: Powerlines	8,257.00	m	1.00	8,257.00	R68.38	R564,613.66	R564,613.66	
Physical	Both	Filling point	Water tanks	Water tanks	1.00	no	2.00	2.00	R560.08	R1,120.16	R1,120.16	
Physical	Both	Filling point	Dust supressant tanks	Steel tanks	1.00	no	2.00	2.00	R1,052.00	R2,104.00	R2,104.00	
Physical	Both	Rapid refuelling station	Concrete	400mm concrete structure	560.00	m³	1.00	560.00	R683.80	R382,928.00	R382,928.00	
Physical	Both	Rapid refuelling station	Diesel tanks	Fuel pumps & tanks	1.00	no	3.00	3.00	R7,936.45	R23,809.34	R23,809.34	
Physical	Both	Rapid refuelling station	Lubricant tanks	Steel tanks	1.00	no	5.00	5.00	R1,052.00	R5,260.00	R5,260.00	
Physical	Both	Rapid refuelling station	Roof sheeting	Light steel	450.00	m²	1.00	450.00	R120.98	R54,441.00	R54,441.00	
Physical	Both	General	Weigh bridge	Weighbridges	240.00	m³	1.00	240.00	R684.45	R164,268.00	R164,268.00	
Physical	Both	General	Culverts	250mm concrete structure	2,160.00	m³	1.00	2,160.00	R578.60	R1,249,776.00	R1,249,776.00	
Biophysical	Both	Finger stockpile	Preparation for rehabilitation	Moderate ripping	65.60	ha	1.00	65.60	R8,580.00	R562,848.00	R562,848.00	The product will be removed prior to cessation of mining, leaving only the footprint to be rehabilitated
Biophysical	Both	Servitude road	Preparation for rehabilitation	Heavy ripping	11.40	ha	1.00	11.40	R12,580.00	R143,412.00	R143,412.00	Heavy ripping applied to roads to alleviate compaction.
Biophysical	Both	Infratsructure areas (Filling points, HME parkup, rapid reload bay)	Preparation for rehabilitation	Moderate ripping	15.00	ha	1.00	15.00	R8,580.00	R128,700.00	R128,700.00	Moderate ripping applied to infrastructure areas - less compacted than roads.
Biophysical	Both	Topsoil stockpile	Preparation for rehabilitation	Moderate ripping	148.70	ha	1.00	148.70	R8,580.00	R1,275,846.00	R1,275,846.00	Assume that topsoil stockpile required for both alternatives.
Biophysical	Alternative 1	Haul roads	Preparation for rehabilitation	Heavy ripping	50.00	ha	1.00	50.00	R12,580.00	R629,000.00		Heavy ripping applied to roads to alleviate compaction.
Biophysical	Alternative 1	Waste rock dump	Alternative 1 cut	WRD Dozing (wet rate)	4,085,521.00	m³	1.00	4,085,521.00	R25.04	R102,301,445.84		
Biophysical	Alternative 1	Waste rock dump	Preparation for rehabilitation	Light ripping	451.40	ha	1.00	451.40	R7,280.00	R3,286,192.00		Light riping applied to WRDs - light compaction.
Biophysical	Alternative 1	General surface rehabilitation	Placement of topsoil	Load & haul topsoil	1,585,200.00	m³	1.00	1,585,200.00	R74.40	R117,938,880.00		The topsoil will be applied at 0.3 meters thick = 3000m3 per ha to be placed.
Biophysical	Alternative 1	General surface rehabilitation	Alternative 1 composting	Compost	528.40	ha	1.00	528.40	R17,100.00	R9,035,640.00		
Biophysical	Alternative 1	General surface rehabilitation	Alternative 1 grassing	Grass seeding	528.40	ha	1.00	528.40	R4,708.35	R2,487,892.14		
Biophysical	Alternative 1	General surface rehabilitation	Alternative 1 tree seeding	Trees/shrub seeding	528.40	ha	1.00	528.40	R6,212.40	R3,282,632.16		
Biophysical	Alternative 1	General surface rehabilitation	Alternative 1 planting trees	WRD Dozing (wet rate)	528.40	m³	1.00	528.40	R25.04	R13,231.14		
Biophysical	Alternative 1	General surface rehabilitation	Alternative 1 inorganic fertiliser	Inorganic fertiliser	528.40	ha	1.00	528.40	R20,754.00	R10,966,413.60		
Transitional	Alternative 1	General	Alternative 1 Post rehabilitation maintenance	Maintenance	528.40	ha/year	5.00	2,642.00	R7,439.61	R19,655,449.62		5 years post closure care & maintenance. Assumption that post closure monitoring will be included in the existing financial provision for the entire mine.

Biophysical	Alternative 2	Haul roads	Preparation for rehabilitation	Heavy ripping	165.00	ha	1.00	165.00	R12,580.00		R2,075,700.00	Heavy ripping applied to roads to alleviate compaction.
Biophysical	Alternative 2	Waste rock dump	Alternative 2 cut	WRD Dozing (wet rate)	9,431,006.00	m³	1.00	9,431,006.00	R25.04		R236,152,390.24	
Biophysical	Alternative 2	Waste rock dump	Preparation for rehabilitation	Light ripping	531.90	ha	1.00	531.90	R7,280.00		R3,872,232.00	Light riping applied to WRDs - light compaction.
Biophysical	Alternative 2	General surface rehabilitation	Placement of topsoil	Load & haul topsoil	1,654,200.00	m³	1.00	1,654,200.00	R74.40		R123,072,480.00	The topsoil will be applied at 0.3 meters thick = 3000m3 per ha to be placed.
Biophysical	Alternative 2	General surface rehabilitation	Alternative 2 composting	Compost	551.40	ha	1.00	551.40	R17,100.00		R9,428,940.00	
Biophysical	Alternative 2	General surface rehabilitation	Alternative 2 grassing	Grass seeding	551.40	ha	1.00	551.40	R4,708.35		R2,596,184.19	
Biophysical	Alternative 2	General surface rehabilitation	Alternative 2 tree seeding	Trees/shrub seeding	551.40	ha	1.00	551.40	R6,212.40		R3,425,517.36	
Biophysical	Alternative 2	General surface rehabilitation	Alternative 2 planting trees	Tree sapling	551.40	ha	1.00	551.40	R8,182.00		R4,511,554.80	
Biophysical	Alternative 2	General surface rehabilitation	Alternative 2 inorganic fertiliser	Inorganic fertiliser	551.40	ha	1.00	551.40	R20,754.00		R11,443,755.60	
Prost closure management	Alternative 2	General	Post rehabilitation maintenance	Maintenance	551.40	ha/year	5.00	2,757.00	R7,439.61		R20,511,004.77	5 years post closure care & maintenance. Assumption that post closure monitoring will be included in the existing financial provision for the entire mine.
Sub-total 1										**R274,289,953.37**	**R421,782,935.84**	
Preliminary & General (20%)										R54,857,990.67	R84,356,587.17	
Contingency (10%)										R27,428,995.34	R42,178,293.58	
Sub-total 2										**R356,576,939.39**	**R548,317,816.59**	
VAT (15%)										R53,486,540.91	R82,247,672.49	
Grand total										R410,063,480.29	R630,565,489.08	

20 Other information required by the competent authority

No information has been requested by the competent authority to date.

20.1 Compliance with the provisions of section 24(4)(a) and (b) read with section 24(3)(a) and (7) of the National Environmental Management Act 107 of 1998

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

Results of investigation, assessment and evaluation of impact on any directly affected person	Reference to where mitigation is reflected
During the Life of Mine, SIOM aims: • To promote employment and advance the social and economic welfare of all employees and uplift all stakeholders within the communities in which they operate. • To contribute to the transformation of the industry. • To ensure that the holders of mining rights contribute to the socio-economic development of the communities in which they operate.	Refer to Section 1.4 of Part B.

20.1.2 Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act 25 of 1999

Results of investigation, assessment and evaluation of impact on any directly affected person	Reference to where mitigation is reflected
According to the *Phase 1 Heritage assessment,* November 2020 compiled by Sidney Miller the SWEP Phase 2 will have no impact on Stone and Iron age archaeological sites or material.	Section 1.4 of Part B.

21 Other matters required in terms of section 24(4)(a) and (b) of the Act

An impact assessment for the SWEP Phase 2 has been undertaken using qualified specialists, which has incorporated extensive consultation with and participation of interested and affected parties. Applying the hierarchical approach to impact management, alternatives were firstly considered to avoid negative impacts, but where avoidance was not possible, to better mitigate and manage negative impacts. Where impacts were found to be potentially significant, various mitigation measures to manage and monitor the impacts of the project have been proposed. Furthermore, the environmental impact statement in Section 11 of Part A summarises the key findings of the environmental impact assessment. No other matters were identified in terms of section 24(4)(a) and (b) of the act.

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

1 Draft environmental management programme

1.1 Details of the EAP

The requirements for the provision of the detail and expertise of the EAP are included in Section 1.2 of Part A.

1.2 Description of the aspects of the activity

The requirement to describe the aspects of the activity that are covered by the draft environmental management programme is included in Section 7.5 of Part A.

1.3 Composite map

Refer to Figure 11 as well as Annexure A for a map that superimposes SWEP Phase 2 associated structures and infrastructures on the environmental sensitivities of the preferred sites.

1.4 Description of the impact management outcomes and actions

Table 18: Mitigation measures for the SWEP Phase 2

No.	Aspect affected	Alternatives	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome/ Standard to be achieved	Time period for implement ation
1	Geology	Waste rock dump and haul alternatives	For all project phases: There are no impacts identified to geology as a result of the construction and operation of the surface infrastructure of the proposed SWEP Phase 2.						
2	Topography	Waste rock dump and haul alternatives	Alteration of the natural drainage patterns.	The disposal of waste rock on the WWRD 5 will influence the nature of the topography that is typical of the surrounding area. Changes to the topography of the site will increase the amount of run-off from site as the waste rock dump has a higher surface area than flat plains.	Construction and Operational	Control	• The disturbance area for the construction will be kept at a minimum and in the designated areas as per the approved layout plans. • Topsoil will be stripped from the proposed footprint areas before construction starts. • Should these stockpiles become a source of windblown dust, they must be vegetated with indigenous vegetation. • All alien invasive flora should be removed from the stockpiles.	Outcome: Ensure minimum change in topography. Preserve sufficient soil volumes to enable pre-mining land capability post-rehabilitation. Standard: Principles in the MPRDA, 2002, NEMA, 1998, NEM:WA, 2008, Regulations there under and amendments thereto. National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (GNR.331 of 2014), thereunder. Rehabilitation, decommissioning- and closure plan and closure objectives.	1-11 years
3	Soils, land use and land capability	Waste rock dump and haul alternatives	Clearing of soil	The removal of topsoil may result in the mixing of the horizons of the soil that will have an impact on the fertility and production potential of the soil.	Construction and operational	Control			1-11 years
				Soil compaction and topsoil loss through erosion may occur as a result of the mining and mining related activities (including the temporary stockpiling). This will further lead to a loss of soil fertility.					
4	Surface water	Waste rock dump and haul alternatives	Grading, vegetation clearing and soil stripping	There may be a deterioration in surface water quality when any surface water runoff comes into contact with dust, eroded soil, or other pollutants generated during the construction phase of the Project. The sediment load within surface water runoff may increase if not prevented or mitigated, or the chemistry of surface water may be altered. Surface water quality: Siltation of water resources causes deterioration of water quality, affecting the use of surface water as a natural resource.	Construction	Control and prevention	• Disturbed areas to be limited to the footprint as depicted in the layout plan. • Place topsoil stockpiles in designated areas with measures in place to prevent erosion and to minimise deposition of sediment in the downstream environment. • The laydown areas for each construction site must be kept as small as reasonably possible.	Outcome: To reduce erosion and siltation resulting from the construction phase. To prevent surface water quality deterioration due to chemical contamination. Standard: National Water Act, 1998 and associated Regulations.	1 year
			Use of hazardous materials	Spillages of hazardous materials (i.e., cement, oil, fuel and / or grease) used during the construction phase of the Project may impact on the surrounding clean water environment. Surface water quality: Deterioration of water quality due to chemical contamination affecting the use of surface water as a natural resource.	Construction	Control	• Treat all hydrocarbon spills as hazardous waste and dispose of accordingly. • Emergency spill kits should be available and emergency spills to be cleaned up quickly and effectively with approved absorbent material. • Ensure that mixing practices are conducted on impermeable surfaces. • All vehicle and equipment usage should be limited to designated areas only. • Store fuel and oil in designated bunded areas. • Refuelling of vehicles to take place on an impermeable surface fitted with a sump to contain any spillages.		
			Silos (Ammonium Nitrate)	Spillages of ammonium nitrate leading to contamination of surface water.	Operational	Control and prevention	• Loading and offloading practices are to be supervised and undertaken by trained staff. • Spillages must be contained. • Clear spillage up promptly. • Storage of ammonium nitrate must take place on an impermeable surface.	Outcome: To prevent surface water quality deterioration due to contamination of ammonium nitrate. Standard: National Water Act, 1998 and associated Regulations.	LOM

No.	Aspect affected	Alternatives	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome/ Standard to be achieved	Time period for implement ation
			Western Waste Rock Dump 5 (“WWRD 5”) Waste Rock Dump (“WRD”)	The WWRD 5 will cover an area of approximately 450 ha and will be roughly 120 m in height. Waste rock from the adjacent pit will be disposed of onto the WRD for the remainder of SIOM’s Life of Mine (“LOM”). The waste rock material is classified as relatively inert with little pollution potential and no acid generating capacity. However, the WWRD 5 contains material particles varying in size from large rocks to fine dust particles. The smaller fraction of these particles is suspended by runoff generated during rainfall events, thus elevating the suspended solids load of the runoff. It is, therefore, assumed that runoff from the WWRD 5 could have a pollution risk, mainly in terms of sedimentation, and all water generated on the WWRD 5 should be considered affected water. The proposed containment berm around the entire WRD will reduce surface water quality impacts, but it will lead to a substantial reduction in runoff reporting to the downstream environment. <u>Surface water quality:</u> Siltation will result in a deterioration of water quality, affecting the use of surface water as a natural resource. <u>Surface water quantity:</u> There will be a decrease in clean water runoff reporting to the catchment, potentially reducing the availability of water to downstream users.	Operational	Control and prevent	• It is recommended to construct a small (0.5 m) diversion/containment berm around the entire WRD to contain sediment laden runoff, and to <u>prevent</u> clean runoff from entering the proposed WRD area. The aim of this strategy is to reduce impacts on surface water quality. • It is recommended to construct a clean storm water earth channel around the eastern and southern toe of the proposed WWRD 5. Clean runoff generated upstream of the WRD will be collected in this channel and conveyed to the downstream environment towards the ephemeral Gamagara River. The aim of this strategy is to prevent clean runoff from ponding against the proposed containment berm, limiting the loss of runoff to the catchment.	<u>Outcome:</u> To prevent / reduce surface water quality deterioration resulting from erosion, siltation and pollution. To preserve surface water quality that enters the receiving environment. To minimise surface water losses to the larger catchment area by ensuring effective drainage of surface runoff to the downstream environment. <u>Standard:</u> National Water Act, 1998 and associated Regulations.	11 years
			Product Stockpile	A 65 ha product stockpiling area will be constructed for the stockpiling of C-grade iron ore. According to the IWWMP (Shangoni, 2019), at the existing stockpiling areas the contamination is limited to predominantly red dust that has a low pollution risk. The dust discolours the storm water runoff but is inert. The stockpiling area will also contain material particles that can be suspended by runoff generated during rainfall events, increasing the sediment load of runoff and reducing surface water quality. The proposed containment berm around the product stockpile will reduce surface water quality impacts but it will lead to a reduction in clean runoff water reporting to the downstream catchment. <u>Surface water quality:</u> Siltation will result in a deterioration of water quality, affecting the use of surface water as a natural resource. <u>Surface water quantity:</u> There will be a decrease in clean water runoff reporting to the downstream catchment, potentially reducing the availability of water to downstream users.	Operational	Control and prevent	• It is recommended to construct small (0.5 m) diversion/containment berm around the proposed product stockpiling area to <u>prevent</u> clean runoff from entering this area and to prevent affected runoff from leaving this area. The aim of this strategy is to separate clean and affected runoff in order to limit surface water quality impacts.		
			Topsoil Stockpile	The area to the south of the WWRD 5 will be used to stockpile topsoil stripped from the footprint areas of the proposed infrastructure. Runoff from this area will have a high sediment load if it comes into contact with the topsoil. Additionally, the stockpiles could be eroded by runoff during rainfall events, which will result in a loss of precious topsoil that should be used for rehabilitation purposes. The proposed containment berm around the stockpile will reduce surface water quality impacts, but it will lead to a reduction in the amount of runoff reporting to the catchment. <u>Surface water quality:</u> Increased sedimentation from the topsoil stockpile will result in a deterioration of water quality, affecting the use of surface water as a natural resource. <u>Surface water quantity:</u> There will be a decrease in clean water runoff reporting to the catchment, potentially reducing the availability of water to downstream users.	Operational	Control and prevent	• It is recommended to construct small (0.5 m) diversion/containment berms around the proposed topsoil stockpiling area to <u>prevent</u> clean runoff from entering the stockpiling area and to prevent erosion of the topsoil. The diversion berms will also serve the purpose of containing runoff with high sediment loads during rainfall events, reducing surface water quality impacts and limiting topsoil losses. • Vegetation growth on the topsoil stockpile should be encouraged.		

No.	Aspect affected	Alternatives	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome/ Standard to be achieved	Time period for implement ation
			Rapid reload bay and HME Park up area	A rapid reload bay will be constructed for the temporary storage of high energy fuel (i.e., emulsion) to be used for blasting. The high energy fuel will be stored in five 76 000 ℓ mobile tankers. The mobile tankers will collect high energy fuel at the HEF plant and transport it to the rapid reload bay. From the rapid reload bay fuel will be transferred into smaller tanker trucks that will transport the emulsion to the blasting area. The 76 000 ℓ mobile tankers will only be parked in the rapid reload bay during the day, after the transfer of fuel is complete, the tankers will return to the HEF plant, and the process will be repeated the next day (or when fuel for blasting is required). There will therefore not be any permanent storage of high energy fuel in the rapid reload bay. Should the emulsion containing tanks leak or burst, it could lead to surface water contamination. Spillages of emulsion may occur during the transfer of fuel from the large tankers to the smaller tankers, which could lead to the contamination of surface water resources. Runoff generated upstream of the rapid reload bay will drain westwards towards the facility and if left unmitigated, clean runoff could come into contact with substances that have the potential to pollute surface water (i.e., emulsion, oil, fuel and / or grease) and reduce water quality. <u>Surface water quality:</u> Deterioration of surface water quality due chemical contamination resulting from leaks, spillages or bursting tanks, affecting the use of surface water as a natural resource.	Operational	Control and prevent	• It is recommended to construct a containment berm around the rapid reload bay to contain any leaks or spillages. • It is also recommended to supply the rapid reload bay with a collection sump to collect and contain any affected water from this area. The sump should be constructed at the lowest point located within the rapid reload bay so that water can naturally drain towards it. • If spillages occur during the transfer of fuel from the large tankers to the smaller tankers, it will pose a risk towards groundwater and soil contamination. Where possible, spillages must be avoided. If such occurs, spillages must be contained, treated and remedied immediately		
			Operation of servitude and haul roads	As part of the Project a servitude road will be constructed west of the WWRD 5. This road will extend from the top of the product stockpile to the bottom of the topsoil stockpile. Multiple haul roads will also be constructed to gain access to the WRD. If left unmitigated surface water will pond against the servitude road as its runoff drains in a westerly direction towards the Gamagara River, resulting in a reduction of surface water quantity. Several haul roads will also be constructed as part of the Project, which could be disrupted and further prevented from reaching downstream areas. Additionally, the road surfaces will be heavily compacted, resulting in impermeable areas where runoff volumes and velocities will increase during rainfall events. This increase in runoff volumes and runoff speed could result in erosion, particularly at concentration points along the roads. <u>Surface water quality:</u> Deterioration of surface water quality due to increased erosion and sedimentation. <u>Surface water quantity:</u> There will be a decrease in clean water runoff reporting to the downstream catchment if runoff is left to pond against the servitude/haul roads, potentially reducing the availability of water to downstream users.	Operational	Control and prevention	• It is recommended to install multiple culverts in the servitude road and in the haul roads to ensure effective drainage of surface runoff to the downstream environment. These culverts should be strategically placed in locations where runoff is likely to accumulate/concentrate. Erosion <u>prevention</u> measures (for example gabions) should be installed at all culverts due to the concentration of runoff in these locations. Regular inspections should be carried out to ensure the integrity of the culverts and to prevent blockages. • It is further recommended that roads be managed in such a manner as to disperse runoff and to prevent the concentration of storm water flow. Storm water should be diverted from all roads through the use of mitre drains and gaps in the roadside berms to disperse runoff and to prevent the concentrating of storm water flow.		

No.	Aspect affected	Alternatives	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome/ Standard to be achieved	Time period for implement ation
5	Groundwater	Alternatives are not applicable in the construction phase.	Construction activities	The impacts on groundwater quality are primarily related to the management of materials, wastes and spills and unauthorised disposal of contaminated substances. Contamination of groundwater may also arise due to incorrect handling and disposal of waste materials. This risk is considered low. Due to the short exposure and small scale of these possible spills, the impacts will be negligible during the construction phase. Except for the lesser oil and diesel spills, there are no activities expected that could impact on regional groundwater quality. This phase should thus cause very little additional impacts. It is expected that the current status quo will be maintained. A very limited groundwater quality impact is expected during the construction phase, generally because of the small surface areas involved and the short duration thereof.	Construction	Avoid, modify, remedy, control or stop	<u>Management measures:</u> • Develop and maintain a Standard Operating Procedure to contain and remediate any accidental hydrocarbon or other chemical spillages. <u>Action plans:</u> • Contain spillage, excavate, and dispose of soil if required. Utilisation of spill kits and/or excavation of affected soil with subsequent disposal at an accredited disposal site is crucial. • Continue with the status quo groundwater monitoring programme. • Uncontrolled discharges from the construction camp/s should not be permitted. • All vehicles must be properly maintained and serviced so that no oil leaks occur on site.	<u>Outcome:</u> Prevent or contain groundwater contamination	N/A
		Impact from WRD alternative 1 & 2 and haul roads alternative 1 & 2)	Operation of activities	Poor quality leachate generation that will impact aquifers underlying the operations associated with the application activities. No sulphidic minerals are present in the waste rock that could result in acidity of drainage or mine water and ABA tests confirmed that no acid potential exists. The waste rock is a low risk waste with no acid generating capacity. It is a relatively inert material with little pollution potential. TDS of the waste rock leachate will be dominated by HCO3, Cl, Na and Ca and possibly nitrogen but will be well within drinking water standards. The plume will be localised to the footprint and little migration is expected due to the low recharge and low hydraulic properties of the aquifer. Leachate quality will remain within drinking water standards with a TDS of ~300 mg/l and will be limited to the shallow aquifer. No sensitive groundwater receptors will be affected.	Operational phase	Avoid, modify, remedy, control or stop	<u>Management measures:</u> • Manage the waste rock dump according to the Sishen Iron Ore Mine Code of practice (“COP”) on mine residue deposits. • Limit the slopes of the waste rock dump to reduce erosion and aid in rehabilitation. • Limit infiltration into the waste rock dump as far as possible. • Separate clean and dirty water and minimise the extent of ‘dirty areas’ as far as practically possible. • Seepage water that does not comply with discharge standards should not be allowed to enter the environment. • Seepage water to be captured, stored, and re-used or discharged if it complies with discharge standards. <u>Action plans:</u> • For long-term stockpiles, apply growth medium (topsoil, compost or other suitable material that can support vegetation) and thereafter a mixture of indigenous grass, trees or shrubs should be planted. • Rehabilitate concurrently and monitor successes in-line with Standard Operating Procedure. • Implement stormwater management systems according to GN 704 principles. • Divert clean water around the waste rock dump. • Continue with the status quo groundwater monitoring programme. • All vehicles to be properly maintained and serviced so that no oil leaks occur on site. • Continue with the status quo groundwater monitoring programme.	<u>Outcome:</u> Prevent or contain groundwater contamination	N/A
6	Biodiversity	Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred) Waste rock dump and haul road Alternative 2	Clearing of vegetation from low to moderate sensitivity areas.	The transformation of extensive natural areas reduces landscape connectivity and loss of ecosystem functioning and services. Loss of protected flora specimens due to clearing of areas for development, which includes protected and endemic species. These areas are of value as they serve as links to allow the migration of fauna and flora between areas on an ecosystem scale.	Site clearance	Modify, Remedy	• Department of Environment Forestry and Fisheries should be engaged to indicate potential reduction, compensation or offsets required for the negative impact on the protected species. • The ECO should enforce any measures that he/she deem necessary to minimise destruction and damage to the environment and specifically wetlands outside of the footprint areas of the mining activities. Regular environmental training should be provided to construction workers to ensure the protection of the wetland habitat.	<u>Outcome:</u> Minimise the clearance of vegetation to the proposed footprint. <u>Standard:</u> Rehabilitation standards	Concurrentl y during life of project (all phases)

No.	Aspect affected	Alternatives	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome/ Standard to be achieved	Time period for implement ation
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Clearing of vegetation from high sensitivity areas (Alternative 01/ Alternative 02)	Moderately sensitive areas such as *Boscia albitrunca* associated grasslands are less represented while providing more significant ecological and diversity functioning. Loss of protected flora specimens due to clearing of areas for development, which includes protected and locally endemic species. These areas are of value as they serve as links to allow the migration of flora between areas on an ecosystem scale.	Site clearance	Modify, Remedy	• Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained. Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area. • Areas and/or individual flora specimens to be avoided must be clearly demarcated before initiation of the site clearance phase as no-go areas. Any nationally protected trees within proximity of the development footprint to be identified as no-go areas or special permits obtained to remove the trees, meeting the obligations of such permits issued. • Use deep-rooted vegetation for biotechnical stabilisation on slopes. Use a mixture of good ground cover plus deep-rooted vegetative species, preferably native species, to minimize deep-seated mass instability as well as offer surface erosion control protection; • Temporary lay-down areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. • The final development area should be surveyed for species suitable for search and rescue, which should be translocated prior to the commencement of vegetation clearance or construction. Ensure all geophytes not concurrently used is stockpiled for re-use in future rehabilitation. • Avoid alien seedbanks by removing aliens annually before they produce seed. It is recommended that an alien invasive plant management plan be compiled and implemented on-site, and that alien monitoring and management is incorporated into the site rehabilitation plan.	In compliance with the Mining Rights issued in terms of the MPRDA (2002), the approved EMPr (and its associated documentation).	
		Waste rock dump and haul road Alternative 2	Clearing of vegetation from high sensitivity areas.				• The ECO should enforce any measures that he/she deem necessary to minimise destruction and damage to the environment and specifically wetlands outside of the footprint areas of the mining activities. Regular environmental training should be provided to construction workers to ensure the protection of the wetland habitat. • Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained. Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area. • Areas and/or individual flora specimens to be avoided must be clearly demarcated before initiation of the site clearance phase as no-go areas. Any nationally protected trees within proximity of the development footprint to be identified as no-go areas or special permits obtained to remove the trees, meeting the obligations of such permits issued. • Use deep-rooted vegetation for biotechnical stabilisation on slopes. Use a mixture of good ground cover plus deep-rooted vegetative species, preferably native species, to minimize deep-seated mass instability as well as offer surface erosion control protection; • Temporary lay-down areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. • The final development area should be surveyed for species suitable for search and rescue, which should be translocated prior to the commencement of vegetation clearance or construction. Ensure all geophytes not concurrently used is stockpiled for re-use in future rehabilitation. • Avoid alien seedbanks by removing aliens annually before they produce seed. It is recommended that an alien invasive plant management plan be compiled and implemented on-site, and that alien monitoring and management is incorporated into the site rehabilitation plan.		
			Clearing of vegetation from very high sensitivity areas	Higher sensitive areas such as ephemeral pans are less represented while providing more significant ecological and diversity functioning. Loss of protected flora specimens due to clearing of areas for development, which includes protected and locally endemic species.	Site clearance	Stop	• Alter the haul road design to avoid destruction of wetland SSNF05.	<u>Outcome:</u> Minimise the clearance of soil to the proposed footprint. <u>Standards:</u> Rehabilitation standards for topsoil stockpiling In compliance with the Mining Rights issued in terms of the MPRDA (2002), the approved EMPr (and its associated documentation)	Concurrentl y during life of project (all phases)
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Clearing of soil from low to high sensitivity areas.	Loss of topsoil, seedbank, microbial resources through physical disturbance. Soil resources are disturbed by means of removal and compaction, as well as polluted due to accidental spills and leaks.	Site clearance	Remedy, Control	• The implementation, monitoring and management of hydrocarbons on site are critical to prevent soil contamination. Monitor equipment for pollution potential: • All vehicles must be regularly inspected for leaks. • Conduct routine site inspections to assess the effectiveness of and the maintenance requirements for erosion and sediment control systems. • Topsoil being stockpiled will be sown with indigenous seed to promote topsoil protection and soil functionality in upper soil layers.		Site clearance and Constructio n phase
		Waste rock dump and haul road Alternative 2							

No.	Aspect affected	Alternatives	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome/ Standard to be achieved	Time period for implementation
			Clearing of soil from very high sensitivity areas	Loss of soil crust related ephemeral species and pan health functionality. Soil resources are disturbed by means of removal and compaction, as well as polluted due to accidental spills and leaks.	Site clearance	Stop	• Alter the haul road design to avoid destruction of wetland SSNF05.		
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Loss of the habitat qualities present in the wetland catchment areas.	Loss of the habitat qualities present in the wetland catchment areas.	Site clearance	Control	• Should the development be approved by authorities, environmental monitoring of environmental aspects should be implemented during the construction phase of the development to ensure that minimal impact is caused to the wetlands outside of the footprint areas of the project. • Work in rivers, streams and wetlands should preferably be done during the low flow season to minimise fauna impact since fauna activity increase during the wet season. • All wetlands affected by the project should be inspected regularly for sedimentation and erosion.	<u>Outcome:</u> Minimise the disturbance of sensitive habitats. <u>Standard:</u> DWS Wetland ID and delineation guideline. WRC – Guide to Wetland Management DWS assessments required. Wetland management required.	Assessments are required before, during and after operations.
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Loss of soil functionality due to storage of soil.	Loss of topsoil resources' functionality due to leaching and loss of seedbank a s part of long-term storage.	Site clearance	Control	• Apply topsoil concurrently as far as practicable. • Topsoil being stockpiled will be sown with indigenous seed to promote topsoil protection and soil functionality in upper soil layers.	<u>Outcome:</u> Minimise the need for stockpiling of soil by using topsoil concurrently on the mine where practically possible. <u>Standards:</u> Rehabilitation standards for topsoil stockpiling In compliance with the Mining Rights issued in terms of the MPRDA (2002), the approved EMPr (and its associated documentation)	Site clearance and Construction phase
		Waste rock dump and haul road Alternative 2					No mitigation measures proposed as topsoil will be used concurrently on the mine where practically possible.		
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Construction & Operation Phase: Earth Works; Operational dust deposition in sensitive habitats.	Air pollution sources on site include land clearing activities, materials handling, wind erosion from disturbed areas and/or stockpiles, dust generated by vehicular movement along unpaved roads, and emissions from machinery and vehicles on site. Air pollution from operational activities such as transportation of waste.	Site clearance; Construction	Control	• Litter storage and housekeeping: maintain a high standard of housekeeping. Store all litter carefully so it cannot be washed or blown into the stormwater drainage systems. • Rubbish bins: provide bins for construction workers and staff at appropriate locations, particularly where food is prepared and consumed. • Dust suppression must be undertaken in conjunction with a dust monitoring programme that places dust deposition gauges or receiving buckets, directional dust collection receptacles, high volume active air samplers or continuous particle monitors or even personal exposure samplers at generation sites, around the mine and in adjacent areas. Dust monitoring is applicable where this is a significant risk or impact on third parties must be monitored. Ensure compliance according to NEMAQA and dust regulations where applicable. • An air quality management programme must be implemented. These should be monitored regularly to ascertain the dust load and emission rates and particle size distribution. Mine health and safety requirements for the use of dust masks must be followed and compliance audited regularly • Implement standard dust control measures, including chemical dust suppressants where appropriate and periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an ongoing basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation; • A speed limit (no more than 60 km/hour) should be enforced on dirt roads; • Topsoil being stockpiled will be sown with indigenous seed to promote topsoil protection and soil functionality in upper soil layers.	<u>Outcome:</u> Prevent the deterioration of air quality. <u>Standards:</u> World Health Organization standards (“WHO”) In compliance with the WHO standards and the approved EMPr (and its associated documentation)	Life of project (all phases)
		Waste rock dump and haul road Alternative 2							
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Increase in noise levels and disturbance.	Noise pollution can be measured as noise disturbance and/or cause noise nuisance, both of which will have	Site clearance; construction; and operational	Control	Ensure that construction activities are staggered, and vehicular activities are kept to a minimum as far as possible. Construction activities generating output levels of 85 dB or more must be confined to normal working hours.	<u>Outcome:</u> Limit the generation of noise through the various activities	Life of project (all phases)

No.	Aspect affected	Alternatives	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome/ Standard to be achieved	Time period for implementation
		Waste rock dump and haul road Alternative 2		different impacts on the receiving environment and receptors.				to prevent the causing of any possible disturbance or discomfort of fauna or communities as a result. Standard: Occupational Safety and Health Administration Standards ("OHSA") In compliance with the OHSA standards and the approved EMPr (and its associated documentation)	
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred) Waste rock dump and haul road Alternative 2	Surface water contamination by means of e.g., hydrocarbon pollution in wetlands.	Mining related developments generally present numerous pollution sources that can negatively impact the surface water quality during all project phases. Some of the pollution sources on site include fuel and lubricants; and residues from ore stockpiles, waste rock dumps or tailings storage facilities.	Construction; and operational	Remedy, control	• 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 environmentally friendly way; • All construction vehicles should be inspected for oil and fuel leaks regularly, and any vehicle showing signs of leaking should be serviced immediately. Maintenance of operating machines and vehicles only to take place in designated areas. • Vehicle maintenance yards must not be situated in any close proximity to water courses and all used oil and other waste products should be disposed of in an accepted way – preferably it should be removed from the site and recycled. • Approved environmentally friendly chemicals should be used as far as possible. • Contractor induction should include environmental awareness and the correct action to take in the event of a hydrocarbon spill. • 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. All hydrocarbons must be stored in bunded areas. • Where the 500 m buffer between any natural wetland / dry pan and the development cannot be avoided, exemption 704 or WUL application must be made. • It is recommended to construct a small (0.5 m) diversion/containment berm around the entire WRD to contain sediment laden runoff, and to prevent clean runoff from entering the proposed WRD area.	Outcome: To prevent degradation of aquatic biodiversity and ecosystems. Standard: National Water Act, 1998 and associated Regulations	Life of project (all phases)
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred) Waste rock dump and haul road Alternative 2	Alteration of the natural drainage patterns.	Changes to the topography of the site will increase the amount of run-off from site as the WRD has a higher surface area than flat plains. Natural drainage lines will also be altered and/or affected.	Site clearance; construction; operational; and closure	Remedy, Control	• Perform scheduled maintenance to be prepared for storms. Ensure that culverts have their maximum capacity, ditches are cleaned, and that channels are free of debris and brush that can plug structures. • Stockpile location: locate stockpiles and material storage away from drainage lines and identified wetland habitat. • Where the 500 m buffer between any natural wetland / dry pan and the development cannot be avoided, exemption 704 or WUL application must be made. • It is recommended to construct a small (0.5 m) diversion/containment berm around the entire WRD to contain sediment laden runoff, and to prevent clean runoff from entering the proposed WRD area. • All wetlands affected by the project should be inspected regularly for sedimentation and erosion. • Concurrent rehab/vegetation replacement of waste dump to increase infiltration and reduce runoff. • Compilation and implementation of an effective stormwater plan specifically compiled for this site, to minimize runoff, erosion, and sedimentation.	In compliance with the DWS standards and the approved EMPr (and its associated documentation)	
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred) Waste rock dump and haul road Alternative 2	WWRD 5 construction in grassland plains.	Large infrastructure such as WRDs will remain post closure as visual impacts, changing the sense of place of future land uses. The development will be located adjacent to existing WRD and should be absorbed by the existing infrastructure to some extent. The area is however located some distance (1,6km from R325 and not visible from N14 National Road) from sensitive receptors and the site clearance and construction phases should have low visual impact.	Operational; and closure	Modify	• All areas are to be rehabilitated concurrently where possible to always keep the visual impact minimal, and if the site must be lit at night, this will be done with low-UV type lights (such as most LEDs), which do not attract insects and associated fauna that feed on these insects. Lights must also be placed in such a manner as to face inwards towards the mine as far as possible, hence further reducing their visual impact. • Increase visual screening along all the national, regional, and divisional roads by planting indigenous tree and shrub lines.	Outcome: Minimise the clearance of vegetation to the proposed footprint. Standard: Rehabilitation standards In compliance with the Mining Rights issued in terms of the	Concurrently during life of project (all phases)

No.	Aspect affected	Alternatives	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome/ Standard to be achieved	Time period for implement ation
		No alternatives are applicable to the silos.	Silos (Ammonium Nitrate)	Impacts on biodiversity due to storage of ammonium nitrate.	Operational	Avoid	• Locality of the silos on a disturbed area to avoid impacts on biodiversity.	MPRDA (2002), the approved EMPr (and its associated documentation).	LOM
7	Sites of Archaeological and Cultural Importance	Waste rock dump and haul alternatives	SWEP Phase 2	For all project phases: No impact to sites of archaeological and cultural importance will occur as a result of the proposed SWEP Phase 2.					
8	Palaeontological	Waste rock dump and haul alternatives	Western Expansion Project of the Western Waste Rock Dump.	Construction activities may disturb or destroy fossils or bedrock of paleontological sensitivity.	Construction	Control	If bedrock is exposed during excavations, a qualified specialist must be appointed to inspect excavations for the presence of fossils. If excavations will not expose bedrock, no further mitigation for paleontological heritage is recommended.	Outcome: To preserve the palaeontology of the area. Standard: Adherence to the requirements of the National Heritage Resources Act (No 25 of 1999.	During construction phase
9	Sensitive landscapes (wetlands)	Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred) Waste rock dump and haul road Alternative 2	Clearing of vegetation from wetland catchment areas.	Loss of protected and/or indigenous flora specimens due to clearing of areas for development, which also includes protected and endemic species. The transformation of sensitive habitats is the main threat of the continuation of these habitats and species dependent on them.	Site clearance	Modify, Remedy	• Where wetland catchments are encroached within the 500 m buffer area around the pan, the required regulation 704 exemption or WUL must be applied to give permission for the construction of the WWRD 5 and infrastructure within the 500 m buffer area. • The ECO should enforce any measures that he/she deem necessary to minimise destruction and damage to the environment and specifically wetlands outside of the footprint areas of the mining activities. Regular environmental training should be provided to construction workers to ensure the protection of the wetland habitat. • Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained. Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area. • Areas and/or individual flora specimens to be avoided must be clearly demarcated before initiation of the site clearance phase as no-go areas. Any nationally protected trees within proximity of the development footprint to be identified as no-go areas or special permits obtained to remove the trees, meeting the obligations of such permits issued. • Use deep-rooted vegetation for biotechnical stabilisation on slopes. Use a mixture of good ground cover plus deep-rooted vegetative species, preferably native species, to minimise deep-seated mass instability as well as offer surface erosion control protection; • Temporary lay-down areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. • The final development area should be surveyed for species suitable for search and rescue, which should be translocated prior to the commencement of vegetation clearance or construction. Ensure all geophytes not concurrently used is stockpiled for re-use in future rehabilitation. • Avoid alien seedbanks by removing aliens annually before they produce seed. It is recommended that an alien invasive plant management plan be compiled and implemented on-site, and that alien monitoring and management is incorporated into the site rehabilitation plan. • The wetland monitoring should take place after construction; during operation and after closure should include but is not limited to: ○ Re-evaluation of the Present Ecological State; ○ The delineation of the wetland (size of the permanent, temporary, and peripheral zone of the wetland). ○ Dominant flora, including alien species monitoring. ○ Fauna interaction; ○ Soil condition (Presence of hydromorphic soil within the temporary zone, gleyed soils (most of the iron has been leached out of the soil leading to a greyish/greenish/bluish colour) and or any mottling (created by a fluctuating water table).	Outcome: Minimise clearance of vegetation from wetland catchment areas. Standard: Rehabilitation standards IAP Standards In compliance with the Mining Rights issued in terms of the MPRDA (2002), the approved EMPr (and its associated documentation)	Concurrentl y during life of project (all phases)

No.	Aspect affected	Alternatives	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome/ Standard to be achieved	Time period for implementation
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Clearing of soil from wetland area buffers	Loss of topsoil, seedbank, microbial resources through physical disturbance. Soil resources are disturbed by means of removal and compaction, as well as polluted due to accidental spills and leaks.	Site clearance	Remedy, Control	• The implementation, monitoring and management of hydrocarbons on site are critical to prevent soil contamination. Monitor equipment for pollution potential: All vehicles must be regularly inspected for leaks. • Conduct routine site inspections to assess the effectiveness of and the maintenance requirements for erosion and sediment control systems. • A topsoil management plan must be compiled and implemented for the project. Topsoil should be applied concurrently to other areas instead of being stored for extensive periods as far as possible. Topsoil being stockpiled will be sown with indigenous seed to promote topsoil protection and soil functionality in upper soil layers.	Outcome: To prevent erosion and siltation of watercourses. Standard: Rehabilitation standards for topsoil stockpiling In compliance with the Mining Rights issued in terms of the MPRDA (2002), the approved EMPr (and its associated documentation)	Site clearance and Construction phase
		Waste rock dump and haul road Alternative 2	Clearing of vegetation from wetland SSNF05	Loss of unique protected, endemic and/or indigenous flora specimens due to clearing of wetland SSNF05 for development. The transformation of sensitive habitats is the main threat of the continuation of these habitats and species dependent on them.	Site clearance	Modify, Remedy	• Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained. Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area. • The alternative layout 1 haul road design is recommended to avoid total destruction of wetland SSNF05.	Outcome: Minimise the impact on sensitive landscapes. Standards: Rehabilitation standards In compliance with the Mining Rights issued in terms of the MPRDA (2002), the approved EMPr (and its associated documentation)	Concurrently during life of project (all phases)
			Clearing of soil from wetland area buffers	Loss of topsoil, seedbank, microbial resources through physical disturbance. Soil resources are disturbed by means of removal and compaction, as well as polluted due to accidental spills and leaks.	Site clearance	Remedy, Control	• The implementation, monitoring and management of hydrocarbons on site are critical to prevent soil contamination. Monitor equipment for pollution potential: All vehicles must be regularly inspected for leaks. • Conduct routine site inspections to assess the effectiveness of and the maintenance requirements for erosion and sediment control systems. • A topsoil management plan must be compiled and implemented for the project. Topsoil should be applied concurrently to other areas instead of being stored for extensive periods as far as practically possible.		
			Clearing of soil from wetland SSNF05	Loss of topsoil, seedbank, microbial resources through physical disturbance. Soil resources are disturbed by means of removal and compaction, as well as polluted due to accidental spills and leaks.	Site clearance	Stop	The alternative layout 1 haul road design is recommended to avoid total destruction of wetland SSNF05.	Outcome: Minimise the impact on sensitive landscapes. Standards: Rehabilitation standards for topsoil stockpiling In compliance with the Mining Rights issued in terms of the MPRDA (2002), the approved EMPr (and its associated documentation)	Site clearance and Construction phase
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Loss of sensitive habitats	Loss of the habitat qualities present in the wetland catchment areas.	Site clearance	Control	• Should the development be approved by authorities, environmental monitoring of environmental aspects should be implemented during the construction phase of the development to ensure that minimal impact is caused to the wetlands outside of the footprint areas of the project. • Work in rivers, streams and wetlands should preferably be done during the low flow season to minimise fauna impact since fauna activity increase during the wet season. • All wetlands affected by the project should be inspected regularly for sedimentation and erosion.	Outcome: Minimise the disturbance of sensitive habitats. Standard: DWS Wetland ID and delineation guideline. WRC – Guide to Wetland Management DWS assessments required. Wetland management required.	Assessments are required before, during and after operations.
		Waste rock dump and haul road Alternative 2	Loss of sensitive habitat surroundings	Loss of the unique habitat offered by wetland SSNF05.	Site clearance	Control			
			Loss of sensitive habitat SSNF05		Site clearance	Stop	The alternative layout 1 haul road design is recommended to avoid total destruction of wetland SSNF05.		
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Construction & Operation Phase: Earth Works; Operational dust deposition in sensitive habitats	Air pollution sources on site include land clearing activities, materials handling, wind erosion from disturbed areas and/or stockpiles, dust generated by	Site clearance; Construction	Control	• Litter storage and housekeeping: maintain a high standard of housekeeping. Store all litter carefully so it cannot be washed or blown into the stormwater drainage systems. • Rubbish bins: provide bins for construction workers and staff at appropriate locations, particularly where food is prepared and consumed.	Outcome: Prevent the deterioration of air quality.	Life of project (all phases)

No.	Aspect affected	Alternatives	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome/ Standard to be achieved	Time period for implement ation
		Waste rock dump and haul road Alternative 2		vehicular movement along unpaved roads, and emissions from machinery and vehicles on site. Air pollution from operational activities such as transportation of waste.			• Dust suppression must be undertaken in conjunction with a dust monitoring programme that places dust deposition gauges or receiving buckets, directional dust collection receptacles, high volume active air samplers or continuous particle monitors or even personal exposure samplers at generation sites, around the mine and in adjacent areas. Dust monitoring is applicable where this is a significant risk or impact on third parties must be monitored. Ensure compliance according to NEMAQA and dust regulations where applicable. • An air quality management programme must be implemented. These should be monitored regularly to ascertain the dust load and emission rates and particle size distribution. Mine health and safety requirements for the use of dust masks must be followed and compliance audited regularly. • Implement standard dust control measures, including chemical dust suppressants where appropriate and periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an ongoing basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation; • A speed limit (no more than 60 km/hour) should be enforced on dirt roads; • Topsoil being stockpiled will be sown with indigenous seed to promote topsoil protection and soil functionality in upper soil layers.	Standards: World Health Organization standards (“WHO”) In compliance with the WHO standards and the approved EMPr (and its associated documentation)	
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Increase in noise levels and disturbance	Noise pollution can be measured as noise disturbance and/or cause noise nuisance, both of which will have different impacts on the receiving environment and receptors.	Site clearance; Construction; Operational	Control	Ensure that construction activities are staggered, and vehicular activities are kept to a minimum as far as possible. Construction activities generating output levels of 85 dB or more must be confined to normal working hours.	Outcome: Limit the generation of noise through the various activities to prevent the causing of any possible disturbance or discomfort of fauna or communities as a result. Standard: Occupational Safety and Health Administration Standards (“OHSA”) In compliance with the OHSA standards and the approved EMPr (and its associated documentation)	Life of project (all phases)
		Waste rock dump and haul road Alternative 2							
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Surface water contamination by means of e.g., hydrocarbon pollution in wetlands	Mining related developments generally present numerous pollution sources that can negatively impact the surface water quality during all project phases. Some of the pollution sources on site include fuel and lubricants; and residues from ore stockpiles, waste rock dumps or tailings storage facilities.	Construction and operational	Remedy, Control	• 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 environmentally friendly way; • All construction vehicles should be inspected for oil and fuel leaks regularly, and any vehicle showing signs of leaking should be serviced immediately. Maintenance of operating machines and vehicles only to take place in designated areas. • Vehicle maintenance yards must not be situated in any proximity to water courses and all used oil and other waste products should be disposed of in an accepted way – preferably it should be removed from the site and recycled. • Approved environmentally friendly chemicals should be used as far as possible. • Contractor induction should include environmental awareness and the correct action to take in the event of a hydrocarbon spill. • Ensure that refuelling stations on site are constructed 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. All hydrocarbons must be stored in bunded areas. • Where the 500 m buffer between any natural wetland / dry pan and the development cannot be avoided, exemption 704 or WUL application must be made. • It is recommended to construct a small (0.5 m) diversion/containment berm around the entire WRD to contain sediment laden runoff, and to prevent clean runoff from entering the proposed WRD area.	Outcome: To prevent degradation of aquatic biodiversity and ecosystems. Standard: National Water Act, 1998 and associated Regulations In compliance with the DWS standards and the approved EMPr (and its associated documentation)	Life of project (all phases)
		Waste rock dump and haul road Alternative 2							
		Waste rock dump, haul road and topsoil stockpile Alternative 1 (preferred)	Alteration of the natural drainage patterns	Changes to the topography of the site will increase the amount of run-off from site as the WWRD 5 has a higher surface area than flat plains. Natural drainage lines will also be altered and/or affected.	Site clearance; construction; Operational; and closure	Remedy, Control	• Perform scheduled maintenance to be prepared for storms. Ensure that culverts have their maximum capacity, ditches are cleaned, and that channels are free of debris and brush that can plug structures. • Stockpile location: locate stockpiles and material storage away from drainage lines and identified wetland habitat.		

No.	Aspect affected	Alternatives	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome/ Standard to be achieved	Time period for implement ation
		Waste rock dump and haul road Alternative 2					• Where the 500 m buffer between any natural wetland / dry pan and the development cannot be avoided, exemption 704 or WUL application must be made. • It is recommended to construct a small (0.5 m) diversion/containment berm around the entire WRD to contain sediment laden runoff, and to prevent clean runoff from entering the proposed WRD area. • All wetlands affected by the project should be inspected regularly for sedimentation and erosion. • Concurrent rehab/vegetation replacement of waste dump to increase infiltration and reduce runoff. • Compilation and implementation of an effective stormwater plan specifically compiled for this site, to minimize runoff, erosion, and sedimentation.		
10	Air quality	Waste rock dump and haul alternatives	Windblown dust from waste dumps, haul roads and screening	Impact on the ambient air quality.	Operational	Control	Watering of haul roads.	Outcome: To reduce the impact on the ambient air quality Standard: National Ambient Air Quality Standards (South Africa) The proposed SWEP will be in compliance with NAAQS at the nearest AQSR.	During the Operational Phase, until cessation of mining activities
		No alternatives are applicable to the silos.	Silos (Ammonium Nitrate)	Risk of fires from storage of ammonium nitrate.	Operational	Control and remedy	• Implementation of fire prevention measures. • Employees need to be trained and practised in the actions to take in a fire. This includes using portable fire-fighting equipment to tackle any fire in its early stages. Portable water fire extinguishers or fire hose reels are appropriate where ammonium nitrate is, or might be, involved. • Storage of ammonium nitrate must be in constructed of non-flammable materials such as brick, concrete or steel. • Do not use organic materials such as sawdust as an aid to cleaning floors		
11	Noise	Various construction and operational activities – WWRD 5 Alternative 1 with Haul Rd Alternative 1	Construction and operational activities associated with the Western WRD and haul road.	The activities may raise ambient sound levels at the identified receptors to such an extent that the noise can be considered disturbing.	Construction and operational	None required	No mitigation measures proposed.	Outcome: Night-time noise limit of 45 dBA. Standard: NCR (GN R154 of 1992), WHO and IFC Noise Limits.	Before the implementation of the Sishen Western Expansion Project.
		Various construction and operational activities – WWRD 5 Alternative 2 with Haul Rd Alternative 1							
		Various construction and operational activities – WWRD 5 Alternative 1 with Haul Rd Alternative 2				Control	Potentially relocation of NSDs living at location 5.		
		Various construction and operational activities – WWRD 5 Alternative 2 with Haul Rd Alternative 2							
12	Visual		Site clearing of the project footprint areas associated with the proposed expansion area, including the stockpiles, WWRD 5, haul roads, filling point etc.	Removal of vegetation leading to increased visual contrast, loss of Visual Absorption Capacity of the landscape and visual intrusion on sensitive receptors.	Construction	To keep development footprint area as small as possible in order to present unnecessary loss of vegetation, control through planning	• The development footprints and disturbed areas should be kept as small as possible, and the areas cleared of natural vegetation with topsoil being kept to a minimum. • The proposed heights should not be exceeded. • As far as possible, existing roads should be used, to avoid excess removal of vegetation for additional haul roads. • The extent of all surface infrastructure footprint areas and permanent structures must be minimised to what is essential. • It must be ensured that existing vegetation in the vicinity of the proposed expansion area and along the roads are retained during the construction phase to act as visual screens from surrounding receptor sites.	Outcome: Minimise the visual impact to surrounding receptors. Standard: Rehabilitation standards In compliance with the Mining Rights issued in terms of the MPRDA (2002), and the approved EMPr	During the construction phase, until cessation of mining activities

No.	Aspect affected	Alternatives	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome/ Standard to be achieved	Time period for implementation
				Alteration of natural features as a result of infrastructure placement and positioning, including potential loss or alterations natural vegetation, leading to loss of visual quality and visual exposure. Natural features act as visual resources and disturbance of such landscape features will also have an impact on landscape character and sense of place of the region.		To prevent loss of sensitive habitat feature that act as visual resources within the area and contribute to landscape character	• Placement of infrastructure outside of the ecologically sensitive areas that also act as visual resources. • Care to be taken during construction to limit alteration of sensitive areas as far as possible. • Appropriate rehabilitation actions to be taken where damage to natural visual resources has taken place.		
			Construction of the WWRD 5, stockpiles, HME Parkup, rapid reload bay and filling points	Excavation during construction of proposed infrastructure will lead to visual intrusion and visual exposure.		To minimise the visual impact from excavations	• Excavation is to be kept to a minimum and limited to essential areas. • The height of structures should be a low as possible, where this can be achieved without unacceptably increasing the infrastructure footprint. • It must be ensured, wherever possible, that existing natural vegetation is to be retained and incorporated into the sites rehabilitation; • It must be ensured that all buildings and other built structures fit its surroundings through the appropriate use of colour and material selection to lower the visibility of the proposed project. • Natural colours should be used in all instances and the use of highly reflective material should be avoided. Any metal surfaces should be painted to fit in with the natural environment in a colour that blends in effectively with the background. White structures are to be avoided as these will contrast significantly with the natural surroundings. • During rehabilitation, the removal of infrastructure and ripping and reshaping of impacted areas should take place.		
				Topographical alteration as a result of construction activities such as the WWRD 5 that will be silhouetted in the skyline, leading to a change in the natural environment which will lead to increased level of visual intrusion and a potential impact on sense of place of the region.		To minimise construction activities and impacts from a project layout that will lead to high levels of topographical alteration	• The height of the WRD and stockpiles should as far as possible not exceed that of the existing adjacent mine dumps, nor that of the proposed design; • It must be ensured, wherever possible, that existing natural vegetation is to be retained and incorporated into the site rehabilitation especially in line of sight from sensitive receptors; • During rehabilitation, it should be ensured that alien vegetation proliferation on the WWRD 5 be mitigated and managed, and should it be deemed feasible the WWRD 5 should be revegetated with indigenous vegetation, to blend in with the surrounding area over time, once vegetation growth has been established.		
			Dumping of waste material at the WWRD 5 and stockpiles; Dust generation especially on a windy day from dumping of waste material on the WWRD 5 and stockpiles.	Continual dumping of material and increasing heights of the WWRD 5 and stockpiles during operational activities.	Operational	To limit visual impacts as a result of dumping of material at the WWRD 5 and stockpiles	• It is recommended that the proposed WWRD 5 and stockpiles be vegetated with indigenous grasses to blend more easily into the existing landscape and for screening purposes. • The design and height increase of the WWRD 5 and stockpiles must be monitored to ensure that these components relate to acceptable environmental standards in terms of slope and elevation. • The WWRD 5 and stockpiles is ideally to be shaped at an adequate slope from the commencement of the project to ensure that it integrates more successfully into the natural topography of the visual landscape. • The WWRD 5 must be shaped and rounded to blend in with the surrounding dumps and to minimise visual contrast and an angular skyline.	Outcome: Minimise the visual impact to surrounding receptors. Standard: Rehabilitation standards In compliance with the Mining Rights issued in terms of the MPRDA (2002), and the approved EMPr	During operational phase
				Mine vehicles driving on haul roads and dumping of waste material on a windy day could lead to temporary atmospheric haziness, which is likely to lead to visual impacts on adjacent receptors.		To limit impacts on the visual environment from haziness caused by dust	• It is recommended that internal roads should be surfaced or appropriately treated to minimise dust. • All dirt and temporary access roads will require dust suppression such as regular watering. • The WRD and stockpiles prone to dust generation must be kept damp during the dry season, and preferably be vegetated in order to minimise the potential for dust generation. • Access roads must be suitably maintained to limit erosion and dust pollution. • Vehicle speed on unpaved roads must be reduced to limit dust generation. • It must be ensured, where possible, that existing natural vegetation is to be retained and incorporated into the design, especially within the line of sight from visual receptors.		

No.	Aspect affected	Alternatives	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome/ Standard to be achieved	Time period for implementation
			Night time lighting associated with the proposed HME Parkup, rapid reload bay and filling points	Night time lighting due to 24 hour operations of the HME Parkup, filling points and rapid reload bay, potentially impacting on receptors.		To limit visual impacts from night time lighting	• A lighting engineer may be consulted to assist in the planning and placement of light fixtures for the HME Parkup, rapid reload bay and filling points to reduce visual impacts associated with glare and light trespass. • As far as possible, operational activities should take place during the daylight hours, to limit the use of bright floodlighting and to avoid the use of additional night-time lighting which may lead to skyglow. • Outdoor lighting must be strictly controlled. • The use of high light masts and high pole top security lighting should be avoided along the periphery of the operations. Any high lighting masts should be covered to reduce sky glow. • Up-lighting of structures must be avoided, with lighting installed at downward angles that provide precisely directed illumination beyond the immediate surrounding of the mining infrastructure, in so doing minimising the light spill and trespass. • Care should be taken when selecting luminaries to ensure that appropriate units are chosen and that their location will reduce spill light and glare to a minimum. Only “full cut-off” light fixtures that direct light only below the horizontal must be used on the building. • Censored and motion lighting may be installed to prevent use of lights when not needed. • Minimum wattage light fixtures should be used, with the minimum intensity necessary to accomplish the light's purpose. • Vehicle-mounted lights or portable light towers are preferred over permanently mounted lighting for night-time maintenance activities. If possible, such lighting should be equipped with hoods or louvers and be aimed toward the ground to avoid causing glare and skyglow (BLM, 2013). • The use of low-pressure sodium lamps, yellow LED lighting, or an equivalent reduces skyglow and wildlife impacts. Bluish-white lighting is more likely to cause glare and attract insects, and is associated with other human physiological issues (BLM, 2013)		During decommissioning and closure phase.
			Demolition of all surface infrastructure	Removal of infrastructure and general decommissioning and closure activities leading to visual intrusion on sensitive receptors.	Decommissioning and closure phase.	To limit visual impacts as a result of mine surface infrastructure decommissioning	• Decommissioning footprints and disturbed areas should be kept as small as possible and no further indigenous vegetation should be cleared or soils exposed for this purpose. • All areas where it is possible to remove infrastructure must be resloped to resemble the pre-development landscape as far as possible and revegetated as soon as possible.		
			Rehabilitation activities.	Ineffective rehabilitation leading to landscape scarring, permanent visual contrast and a permanent alteration of the landscape character and sense of place within the region.		To ensure that effective rehabilitation takes place in such a way as to prevent permanent visual impacts remaining post-closure	• Rehabilitation must be implemented, and disturbed areas must be rehabilitated as soon as possible and as soon as areas become available by replacing topsoil and revegetating disturbed areas. • Indigenous and locally occurring plant species selected for use in re-vegetation should be selected taken quick growth rates into consideration to cover bare areas and prevent soil erosion. • Upon final rehabilitation, it must be aimed to remove as much surface infrastructure, and to reshape the landscape of the removed surface infrastructure to pre-development conditions.		
13	Socio-economic	Waste rock dump and haul alternatives	Construction of the proposed SWEP Phase 2 project.	Jobs will be retained, and additional jobs created providing income and, therefore, having a further positive impact on the regional socio-economy aspects of the area, along with other benefits arising from the Social and Labour Plan.	Construction and operational	Control	• Ensure a transparent employment system is in place. • The beneficiaries of local economic opportunities must as far as possible be from the local community. • Develop a recruitment policy that allows equal opportunity to all people (woman, disabled) and give preference to local labour. • A complaints register should be kept, and the following should be recorded, investigated and feedback provided to complainants: o Name and surname of complainant, o Contact details of complainant, o Date of complaint, o Person or department responsible for complaint, o Actions for implementation (if any), o Date of implementation, o Date of feedback provided to complainant, and o Indication if complaint is closed or open.	Outcome: To maximise economic opportunities for local employment and development. Standard: Mineral and Petroleum Resources Development Act (MPRDA) (Act 28 of 2002). Social and Labour Plan.	11 years.

1.5 Closure objectives and financial provision

1.5.1 Closure objectives (EIAR/EMPr 2017)

The following information was obtained from the report *Anglo American: Kumba Iron Ore - Sishen Mine: Preliminary Closure Plan*, dated 2017 and compiled by Shangoni Management services (Pty) Ltd.

The overarching goals for closure are described below, and give effect to physical, biophysical, and social closure objectives tabled below:

- A walk-away closure with limited / no significant long-term liabilities that require management;
- Rehabilitation is of high quality and sustainable into the predictable future;
- Proposed post-closure land uses are sustainable;
- Stakeholder engagement is undertaken, and their views have been considered in closure planning;
- Permanent SIOM employees have been successfully redeployed or re-skilled;
- Legal compliance has been achieved;
- Authorities will be satisfied with the extent of rehabilitation and closure criteria; and
- The DMR will be satisfied to issue a closure certificate with limited / no significant conditions attached.

From the overarching goals the following objectives are applicable to SIOM:

Table 19: Detailed Closure Objectives (Preliminary Closure Plan)

Physical Objectives	Biophysical Objectives	Social objectives
All the rehabilitated land is safe and useable, excluding the open pits and potentially the pit-facing slopes of the WWRD 5, which will be wilderness.	Minimise all negative impacts on the bio-physical environment as far as possible.	Ensure that issues will be addressed and managed so that the main objective and acceptable closure plan can be attained.
All rubble from plant decommissioning and related areas do not cause long term degradation or become a safety hazard.	Those rehabilitated areas can be utilised in a sustainable manner.	Stakeholder engagement is undertaken, and their views must be considered during closure planning.
All waste dumps be closed and rehabilitated as per the legislative framework.	Ground- and surface water will not be polluted once the mine is closed. (e.g., slimes dams);	Permanent employees will be re-deployed and re-skilled to minimise job losses as far as possible.
Land be physically and chemical stable.	To ensure legal compliance in terms of biophysical closure.	To stimulate the economy of the area by implementing viable projects that will enable some of the employees to be redeployed within that sector.
The safety zone of the open pit is established, and suitable measures taken to prohibit access.		That rehabilitation work as well as other related work with regards to closure is not outsourced but that ex-employees can form part of this process, as far as possible, ensuring job continuation after closure.
		That mine owned houses are sold to individuals.
		Those employees are generally satisfied with re-deployment, re-skilling, and alternative employment opportunities.

1.5.2 Closure objectives (EMPr 2002)

The following information was obtained from the Sishen Iron Ore Mine Environmental Management Programme Report, July 2002.

Table 20: 2002 closure objectives

Element	Summary of impact assessment	Closure objective
A6.2.1 Geology	The geology at the Sishen Iron Ore Mine has been highly impacted upon due to blasting, excavation and the removal of iron ore.	No mitigation is achievable.
A6.2.2 Topography - Waste dumps	The deposition of waste rock has impacted on the topography of the area.	All mine infrastructures will be removed at closure, and disturbed areas rehabilitated. All residue deposits at closure will be sloped to 18° and rehabilitated. If experimentation undertaken by the mine is able to successfully rehabilitate the residue deposits at steeper angles and agreed to by the DME, then the recommendations of the experimentations will be implemented.
A6.2.3 Soils	Shallow (15cm average) soils of the area have been disturbed by mining activities, which invariably leads to some topsoil loss.	Growth medium will be placed on all disturbed areas. Actual medium to be used and depths of cover is still to be determined experimentally by 2006.
6.2.4 Land capability	Land capability has been impacted upon by the deposition of the waste rock dumps, slimes dams and by general mining operations	All disturbed areas will be rehabilitated to accommodate small livestock farming, except for the remaining open pit.
A6.2.5 Land use	Change of land use from small-scale livestock farming to mining.	Land use will be reverted back to small-scale livestock farming by ±2030.
A6.2.6 Natural vegetation	The natural vegetation at the site has been negatively impacted upon in the mining area.	Naturally occurring (indigenous) species will be used in the re-vegetation of disturbed areas. Optimal crown and basal cover of disturbed areas will be determined experimentally in conjunction with DME.
A6.2.8 Surface water	The post closure impacts on surface water will be related to the reduction in catchments yield as a result of evaporation from the open pits.	A storm water drainage system will be implemented to mimic the natural drainage direction. All surface sources of potential pollution will be removed. Water use charges will be negotiated with DWAF.
A6.2.9 Ground water	Mining has impacted on the ground water levels as a consequence of the dewatering program and excavation of the pit. In isolated areas the water quality has been impacted by organic and inorganic contamination.	Post operational ground water levels have been modelled, and are expected to return to 30m below the original surface elevation (see figure 5.4.2 A-D). Nitrate concentrations in the groundwater will be kept to within the legal limits for potable water. Sources of organic pollution will be removed. All groundwater extraction infrastructures will be handed over to DWAF as per current permit stipulation.
A6.2.10 Air quality	The air quality at the mine has been impacted upon by dust.	Disturbed areas will be covered with a growth medium and re-vegetated. An exact objective (tons per annum) for the amount of dust export will only be available in December 2003.
A6.2.11 Noise	Noise impact generated by mining is confined to within the mining operation.	Noise levels at closure will be limited to DWAF pumping scheme and other small scale industries that form part of the mines social investment initiatives.
A6.2.12 Sensitive landscapes	Several sensitive landscapes exist on the mine property.	Sensitive landscapes will only be mined with the permission of the relevant authorities. Any closure requirements will be adhered to.
A6.2.13 Visual aspects	The visual landscape at Sishen has been impacted upon by mining	Refer to the section on topography. A detailed visual impact assessment is

Element	Summary of impact assessment	Closure objective
	operations. This includes the waste rock dumps, slimes dams, tailings dumps and excavations.	being carried out, which will determine if any further mitigation is necessary, the survey is to be completed by October 2003.
A6.2.14 Regional socio-economic structure	The mine has had a large positive impact on the regional socio-economic structure. About 3 200 people are employed by the mine, and most of the retail outlets in Kathu are dependent on the mine. The mine also provided the infrastructure and water supply at Kathu, Sesheng and Dingleton.	The mine is currently busy with a number of long-term sustainable development programs (see Appendix 25 Social responsibility report).

1.6 Mechanisms for monitoring compliance

The aim of environmental monitoring and auditing is to develop a cost-effective approach to monitoring the operations' environmental performance. Certain parameters (e.g., water quality) can be monitored through measurements, others can only be monitored through observation (e.g., maintenance effectiveness). However, in all cases anticipation of environmental problems through assessment of the environmental impact of the operations' working methods, followed by forward planning to prevent problems or at least limit their effects, is the key to successful environmental management.

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

- Monitoring of impact management actions;
- Monitoring and reporting frequency;
- Responsible persons;
- Time period for implementing impact management actions; and
- Mechanism for monitoring compliance

Table 21: Impacts monitoring programme as applicable to the SWEP Phase 2 project

NO	SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES)	MONITORING AND REPORTING FREQUENCY
1	EIAR/EMPr compliance (external)	Auditing of environmental authorisation, environmental management programme and closure plan must be done in accordance with the Regulation 34 and Appendix 7 of the EIA Regulations (2014) under the NEMA (1998). EIAR/EMPr audits shall be in accordance with the period specified in the approved EMPr, every 2 years or as agreed in writing by the Minister. The audits will be undertaken by an independent third party.	A formal Audit Report will be submitted to the DMRE biennially.	Environmental Department	Every second year
2	EIAR/EMPr compliance (internal)	Compliance with the approved EIAR/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.	Environmental Department	Annually

3	Water quantity & quality monitoring	Monitoring of surface and ground water resources will take place according to the IWUL. The mine's water quality monitoring is conducted by an external consultant.	Water quantity & quality monitoring results will be reported to DWS as per the IWUL requirements. These results will be reported to DMRE on an annual basis.	Environmental Department	As per the Integrated water use licence ("IWUL")
4	Environmental noise monitoring	An environmental baseline noise survey will be undertaken on an annual basis at sensitive noise receptor areas around the mine, or alternatively, when new expansion projects are planned. The annually noise survey will be undertaken by an external consultant.	Noise baseline survey to be submitted to DMRE on annual basis.	Environmental Department	Annually
5	Vibration and air blast monitoring	The vibration and air blast arising from all blasts at SIOM is monitored by an external consultant.	Blast and air blast data will be reported to DMRE on an annual basis	Mining Department	Annually
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 DMRE on an annual basis	Environmental Department	Every 5 years
7	Air Quality Monitoring	The mine's air quality monitoring program comprises of PM10, PM2.5 and dust fallout monitoring. PM10, PM2.5 monitoring is by means of permanently mounted particulate monitors that sends data to an online database.	Air quality monitoring results will be reported to DAFF on an annual basis.	Environmental Department	Annually
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 DMRE on an annual basis.	Environmental Department	Annually
9	Topsoil monitoring	The volumes of topsoil removed, stockpiled, and used for rehabilitation will be recorded.	Topsoil volumes will be reported to DMRE on an annual basis.	Environmental Department	Annually

10	Contaminated soil monitoring	The volumes of contaminated soil generated, stockpiled, treated, disposed, etc. will be recorded.	Contaminated soil volumes will be reported to DMRE on an annual basis.	Environmental Department	Annually
11	Progress with implementation of storm water management plan	Implementation of the Stormwater management plan for SWEP Phase 2, 2021 compiled by Shangoni Management Services.	Progress with implementation of the mine's storm water plan will be reported to DMRE and DWS on an annual basis.	Environmental Department	Annually
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.	Environmental Department	Annually
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.	Environmental Department	Annually
14	Legal compliance audits (external)	An external legal compliance audit (environmental) will be undertaken by an independent third party on an annual basis.	Records of external legal audits will be retained at the mine.	Environmental Department	Annually
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 DWS on an annual basis.	Environmental Department	Annually

1.7 Programme for reporting on compliance

Unless otherwise instructed by the Competent Authority (in this case, the DMRE) or as a condition to the EA, environmental compliance audits on the EMPr will be undertaken biennially, and the resultant audit reports will be submitted to the DMRE. The auditing process, as well as report format will comply with the requirements as contained in the EIA Regulations, GN R982, dated December 2014, as amended.

1.8 Environmental awareness plan

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, 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 considers 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 to prevent and limit possible impacts.
- To minimise 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.

Some of the EMS elements listed above are described in the sections below.

1.8.1 Environmental awareness and training program

SIOM 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 SIOM 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 receive SHEQ (Safety, Health, Environmental and Quality) 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. The mine also conducts training during the shift training sessions and monthly environmental topics are circulated through the mine's communication systems.

1.8.2 Public engagement strategy

Public engagement will take place by means of Sishen Public Engagement Forum ("PEF") meetings to be facilitated each year. The information sharing at the proposed PEF will be more generic with information sharing. As a guideline, the following aspects will be considered for discussion at the PEF:

- Production achieved at the mine;
- Initiatives undertaken to mitigate its environmental impacts;
- Any authority site visits undertaken or a description of instances where positive interaction occurred with the authorities;
- A general description of new projects especially focusing on environmental improvements; and
- Assurance that the complaints system is operational and report back on matters resolved.

SIOM will engage with selected community stakeholders and farmers on environmental management issues and complaints. Such engagement will be undertaken by invitation. SIOM has a stakeholder manager working specifically with the farmers and this channel serves as further means for farmers to engage with the mine.

Complaints received from the public will be dealt with in accordance with SIOM's complaints procedure.

1.8.3 Emergency preparedness and response

SIOM has established an emergency preparedness and response procedure that sets out roles & responsibilities and the action to be taken in the event of different types of emergencies. These include power failures, fires, flooding, major chemical / hydrocarbon spills, dam wall failures and various others. The procedure is revised from time-to-time as deemed appropriate by the mine. All emergencies at SIOM are dealt with in terms of this procedure.

1.8.4 Environmental monitoring, measurement, auditing, and reporting

Refer to Section 1.7 of Part B above.

1.8.5 Non-conformities and corrective action

SIOM has an established procedure for dealing with accidents and non-conformances. The procedure requires that any person who detects any non-conformities in their work area, should report this on the mine's incident reporting system.

Following the reporting of an incident, it is investigated, and corrective measures implemented to prevent re-occurrences.

1.9 Specific information required by the Competent Authority

The information, as presented in the table below, will be required by the competent authority.

Table 22: Monitoring information required by the competent authority

Information	Frequency of submission
Quantum of financial provision	Annually
Annual rehabilitation plan	Annually
Environmental audit report on approved EMPr and other environmental authorisations	Biennially or as per auditing timeframe indicated in authorisation(s)
Surface water monitoring reports	As per IWUL
Groundwater monitoring reports	As per IWUL
Dust monitoring reports	Annually
Noise monitoring reports	Annually

2 Undertaking

The EAP herewith confirms

- the correctness of the information provided in the reports ☒
- the inclusion of comments and inputs from stakeholders and I&APs ; ☐
- the inclusion of inputs and recommendations from the specialist reports where relevant; ☒and
- the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed; ☒

September 2021

Signature of EAP **Date**

3 Declaration of independence

Shangoni hereby declares that it is an independent EAP has no business, financial, personal or other interest in this project in respect of which Shangoni is appointed. Furthermore, no circumstances exist that may compromise the objectivity of Shangoni, excluding fair remuneration for work performed in connection with this project.

Report compiled by:	**DRAFT FOR REVIEW**	**Report reviewed by:**	**DRAFT FOR REVIEW**
	Lee-Anne Fellowes		**Brian Hayes (Pr Eng)**
	(Registered EAP and Pr.Sci. Nat)		