SUITE 221 | PRIVATE BAG X01 | BRANDHOF | 9324
8 CONDE STREET | BAYSWATER | BLOEMFONTEIN | 9301
TEL: 072 967 7962
E-MAIL: louis@turn180.co.za

TURN180
ENVIRONMENTAL CONSULTANTS

DRAFT ENVIRONMENTAL SCOPING REPORT

PROPOSED REHABILITATION OF THE PIT ON PORTION 15 OF THE FARM JAGERSFONTEIN 14 BY INFILLING OF FINE AND COARSE TAILINGS AND SAND FROM THE DIAMOND EXTRACTION PROCESSING PLANT, FAURESMITH RD, FREE STATE

April 2018

Applicant:

Jagersfontein Developments (Pty) Ltd

Contact person	Mr. H. Van Zuydam
Postal Address:	P.O. Box 263
	Durbanville
	7550
Tel.:	082 324 4300

Prepared by:

Turn 180 Environmental Consultants

Contact person:	Louis De Villiers
Postal address:	Suite 221
	Private Bag X01
	Brandhof
	9324
Tel:	072 967 7962
E-mail:	louis@turn180.co.za

EXECUTIVE SUMMARY

Jagersfontein Developments (Pty) Ltd ("**JD**") proposes to rehabilitate the historically mined pit (the "**Pit**" or "**Site**") on Portion 15 of the Farm Jagersfontein 14 IS, Fauriesmith District, Free State ("**Farm Jagersfontein**") as part of an initiative to restore the Pit's safety. Portion 15 of the Farm Jagersfontein ("**Portion 15**") is owned by JD.

The rehabilitation initiative will involve infilling the Pit with fine and coarse tailings ("**Backfill Material**") generated from JD's existing diamond extraction Plant (the "**Plant**") to make the bottom of the Pit shallower (the "**Project**").

The Project will require a Waste Management License ("**WML**") in terms of the National Environmental Management: Waste Act 59 of 2008 ("**NEMWA**") and a Water Use License ("**WUL**") in terms of section 21(g) of the National Water Act 36 of 1998 ("**NWA'**). The application for the WML will be conducted in accordance with the Environmental Impact Assessment ("**EIA**") Regulations of 2014 as amended in 2017 ("**EIA Regulations**"), published under the National Environmental Management Act ("**NEMA**").

The Pit was formed in the 1870s when the Farm Jagersfontein was proclaimed a public digging. It is the biggest hand-excavated hole in the world and, given its historical value, is a heritage resource under section 3 of the National Heritage Resources Act 25 of 1999 ("**NHRA**"). The Pit has, however, not been given any formal protection by the South African Heritage Resources Agency ("**SAHRA**") or Free State Heritage Resources Authority ("**FSHRA**") under the NHRA.

The Pit has an extent of 19.635ha and is a near vertical sided hole, with some of the faces being more than 200m in height. It is unstable, breaking back and poses vibration risks. The Pit's instability presents a very serious safety risk, placing local residents at potential risk in the long term. Due to the safety risks, it cannot be accessed by the public and is therefore closed for public viewing.

JD appointed a geotechnical and structural engineering specialist, Dr. Graham Howell (Professional Civil Engineer, Corporate Consultant and ex-Chairman of SRK Consulting (SA) Pty Ltd), who has undertaken extensive and on-going assessments. Dr. Graham Howell has confirmed that using tailings for the Pit's rehabilitation is the only viable and practical way to ensure its stability and eliminate associated risks.

The Farm Jagersfontein is scarred from mining operations that have been conducted for over 100 years and is in a state of environmental degradation. Processing of the tailings dumps and backfilling them into the Pit is an environmentally sound project, which will lead to land's rehabilitation. A calculation by Dr. Howell indicated that with the volume of tailings available to be processed the Pit will be backfilled to a depth of approximately 60m from the top. It should be noted that this is dependent on when this activity will commence and how much surface tailings are available for reprocessing at that stage. If the activity

is authorized early, it is expected that this void will be smaller as there will be more tailings available for backfilling of the Pit. The opposite is true in the event that the project commences very late.

JD's surface tailings processing operations ("**Tailings Operation**") and the Plant are situated in the Xhariep District Municipality of the Free State Province. The Tailings Operation entails reprocessing eleven tailings dumps, where coarse tailings from historic diamond mining operations have been discarded (the "**Tailings Dumps**") at the Plant. JD purchased the Tailings Dumps from De Beers in 2010.

The operational area of the Tailings Operation extends over Portion 16 and the Remaining Extent of the Farm Jagersfontein (the "**Operational Site**"), with a combined area of 5, 945ha. Portion 15 does not form part of the Operational Site.

Currently the Tailings Operation utilises the existing Fine Tailings Storage Facilities ("**FTSF**") for storage of the fine tailings from the Plant. Coarse tailings are returned to the existing footprints from where they were removed and used to stabilise the FTSF's walls.

However, it was determined that the coarse and fine tailings can be utilised for infilling to rehabilitate the Pit. This will restore the Pit's stability. It will also remove all current tailings from the Operational Site, ensuring more effective rehabilitation of this Site and creating opportunities for agricultural development. The Pit's rehabilitation will also lessen the groundwater impacts on the shallow aquifer, currently caused by the presence of tailings on the Operational Site.

The Tailings Operation will produce between approximately a further 38.039 million tons to 45.275 million tons of tailings (i.e. coarse and fine tailings), which will be used to rehabilitate the Pit over the Operation's lifetime. The Pit has the capacity to contain approximately 51.94192 million tons of tailings. A percentage of this has already been processed and stored on the FTSF.

Processes undertaken at the Tailings Operation include the ploughing and / or ripping of the Tailings Dumps to loosen tailings before it is loaded onto conveyors, which transport it to the Plant. The Plant consists of 4 X 75 tons/hour Dense Medium Separator ("**DMS"**) Plants, which are used to separate the mineral particles in a sink-float process. A suspension of dense powder in water is used, which forms a heavier liquid, for the separation. This causes the heavier material containing diamonds to sink and the lighter material to float. The material is further separated into coarse tailings and fine tailings suspended in water. The fine tailings are then further dewatered to a paste before being deposited. These products will be used to rehabilitate the Pit. The Plant has a minimum processing target of 300 tons of tailings per hour.

Alternatives

The following alternatives were considered:

1. Location alternatives:

   Given that the existing Pit needs to be rehabilitated at its current location on Portion 15, there are no location alternatives.

2. Alternative methods to backfilling the Pit

   2.1. Fencing

   The only feasible alternative to backfilling the Pit with tailings is to maintain the fence around it on the surface to prevent people and larger animals from entering the area. The fence, however, provides no absolute barrier against trespassing. Furthermore, the Pit's instability will persist, with the risk that vibrations and break-back of the Pit's walls might cause injury to trespassers or damage to surrounding property and the fence itself. Breakback episodes are intermittent and unpredictable. Regular survey and drone surveys are performed. Current activity is only a minor erosional process, but large block breakback can always be expected.

   2.2. Civil Engineering Stabilisation Mechanisms

   Dr. Howell investigated whether there are any civil engineering mechanisms that could be used to stabilise the Pit. He concluded that it is impractical to carry out any stabilisation work due to the geological circumstances present at the Pit. If it were possible, it would be a world first and the biggest endeavour of its kind in the world and extremely expensive. This is discussed further in section 5 below; however, given that it is not feasible, it is not assessed as an alternative in this Scoping Report.

3. Technological alternative (i.e. infilling of material):

   3.1. Method of transportation of material into the Pit

   The preferred method of transportation and infilling of the Backfill Material is via a conveyor and pipe. A conveyor will be used to transport coarse tailings, whilst the paste, will be transported via a pipe.

   An alternative mode of transportation of the Backfill Material to the Pit will be the use of trucks. However, due to fuel consumption, it will be very costly and have a larger carbon footprint due to burning of fossil fuels and physical footprint as a result of the roads. Travelling on dirt roads by truck will also create higher emissions of dust. Due to safety reasons the trucks will also not be permitted to enter the area close to the Pit and will have to make use of a shorter conveyor and pipe.

3.2. Method of infilling

The proposed method of infilling will involve the constant change of the discharge point of the tailings into the Pit and also the type of tailings discharged into the Pit to ensure a balance between coarse and fine tailings. Coarse tailings will be used to "line" the base of the Pit and form a base layer as the permeability of the coarse tailings is high. The permeability of the paste which will be deposited on the base layer is very low and has very little "free" water. Movement of water from the paste is therefore very slow. The grading of the coarse tailings is also fine enough to prevent the extrusion of paste through its mass. This will result in minimal seepage of water contained in the suspended material. The method will be further discussed in detail on completion of the design of the infilling by Dr. Howell.

An alternative method to infilling the Pit is to establish one point from where coarse tailings and the paste are discharged into the Pit. This will entail the co-disposal of coarse tailings and paste. This method will result in unpredictability of movement of the paste as the mixture will be dominated by the mobility of the paste. Thus, there will be no base layer.

3.3. Lining

It was determined that the tailings are classified as a Type 3 waste which, in terms of the National Norms and Standards for Disposal of Waste to Landfill under NEMWA published under GN R636 in *GG* 36784 of 23 August 2013 (**Landfill Norms and Standards**), requires a liner consistent with a Class C barrier system.

Due to the Pit's size, depth, inaccessibility and the significant health and safety risks to line it, a liner of this type is unpractical, if not impossible. Even if it was possible, the costs of such lining would make it unfeasible. Furthermore, groundwater modelling done by GHT Consulting ("**GHT**") in 2017 indicated through simulations that the migration of the pollution plume from the filled Pit will be limited due to the following reasons:

- Filling of the Pit would not reach the surface and would thus not reach the base of the exploitable aquifer,
- The geohydrological properties of the paste (as discussed in Section 3.2)

  (Please refer to Chapter 9 of the Geo-hydrological study by GHT attached in Annexure 4)

The need to backfill the Pit due to safety risk clearly outweighs any need to line the Pit due to pollution risks. An application will therefore be made in terms of section 74 of NEMWA for

exemption from the application of the Landfill Norms and Standards. The Scoping and EIA Report will therefore not incorporate lining of the Pit as an alternative.

3.4. No Go: The Pit will not be rehabilitated by infilling

Should the no-go option be decided on, the Pit will not be backfilled with tailings and will be left dormant and the coarse tailings and paste will be disposed of into a FTSF. However, due to costs associated with this option it is not regarded as economically feasible. The Pit will continue to be fenced and access controlled in an attempt to make it safe.

(The alternatives will be discussed in more detail in Section 5 of this report)

Baseline Assessments

A baseline site assessment was undertaken by Mr. Louis De Villiers to identify and assess any potential impacts associated with filling the Pit. This was followed by numerous discussions with specialists and the operations manager.

Due to the historic mining activities on the Operational Site, much of the information required to compile this Scoping Report was available. Numerous specialist studies have also previously been undertaken at the Pit, including by Dr. Howell and historical data is available. Studies included the classification of the coarse and fine tailings which will be used to fill the Pit. The characteristics of the tailings will be discussed in more detail in this Scoping Report.

Public Participation

The Public Participation Process ("**PPP**") will be conducted according to the EIA Regulations' minimum requirements.

Comments, responses and proof of notifications sent during the PPP will be included in Section 8 and **Annexure 3** of this Scoping Report (refer to attached document in **Annexure 3**).

TABLE OF CONTENTS

List of Appendices

1 Introduction

This Scoping Report forms part of the EIA process currently underway in accordance with the EIA Regulations. The purpose of the EIA is to obtain a WML under NEMWA for the Pit's rehabilitation.

The Pit is geologically unstable, breaking back and poses vibration risks. The instability of the Pit poses a very serious safety risk, vitiating tourism opportunities and placing local residents at potential risk in the long term. JD appointed a geotechnical and structural engineering specialist, Dr. Howell (Professional Civil Engineer, Corporate Consultant and ex-Chairman of SRK Consulting (SA) Pty Ltd), who has undertaken extensive and on-going assessments. The specialist has confirmed that the use of tailings for the Pit's rehabilitation is the only feasible, viable and practical way to ensure its stability and eliminate associated risks.

The Tailings Operation entails the reprocessing of the eleven Tailings Dumps (where the coarse tailings from historic diamond mining operations were discarded) and the processing of tailings at the Plant.

At present, the Tailings Operation utilises the existing FTSF for the storage of the fine tailings from the Plant. Coarse tailings are returned to the existing footprints from where they were removed.

However, it has been determined that the Pit could be rehabilitated by filling it with the coarse and fine tailings from the Tailings Operation. For the filling, a conveyer will be used to transport the coarse tailings into the Pit, whilst the fine tailings paste will be transported by pipes over the edge of and into the Pit. The infilling process / design will be determined by Dr. Howell, to ensure it meets certified specifications, so as to minimise environmental impacts and / or risks.

The Tailings Operation will produce between approximately a further 38.039 million tons to 45.275 million tons of tailings (i.e. coarse and fine tailings), which will be used to rehabilitate the Pit over the Operation's lifetime. The Pit has the capacity to contain approximately 51.94192 million tons of tailings. A percentage of this has already been processed and stored in the FTSF.

1.1 Background to the Site

The large empty Pit is situated on Portion 15. JD is the landowner of Portion 15, which it acquired from De Beers.

Diamonds were discovered in the area in 1868. Jagersfontein Diamond Mine was proclaimed in 1871. The Pit was created by various parties over a period of 40 years from 1870, through opencast mining of Portion 15. Jagersfontein Mining and Exploration Company was the last entity which mined the Pit utilising opencast mining. This mining ceased in 1913.

Between 1913 and 1970 underground mining took place intermittently on Portion 15 and the adjacent properties, using a sequence of 'block-caving' mining methods maintained by the main shaft present on Portion 15 (the "**Shaft**"), a sub-shaft and declines. The workings reached to a depth of 865m, with extensive development at all levels.

De Beers took control of the Jagersfontein Mine in 1940 and purchased Portion 15 in 1949. It did not mine the Pit at any stage through opencast methods and undertook underground mining until mining was stopped in 1969. The Jagersfontein Mine was closed in 1971. The Operational Site has been derelict since that time, save for reprocessing of the Tailings Dumps.

JD obtained ownership of the Site and Tailings Dumps in 2010 from De Beers and has proceeded with the re-processing at the Plant.

The Pit is the oldest and largest hand-dug pit in the world and is a heritage resource in terms of the NHRA, as it constitutes an archaeological site under section 35 of the NHRA. It has, however, not been given any formal protection by the SAHRA or FSHRA under the NHRA. The Pit attracts minimal tourists, as it is in a neglected state. The Jagersfontein Town is also situated in a remote location and has very little tourist facilities, save for one small guesthouse. The SAHRA and FSHRA have confirmed that they do not have the capacity to manage the Pit or Jagersfontein Town.

Portion 15 covers an area of 53.4552ha, which includes the Pit and the area surrounding it. The Pit has a surface area of 19.635ha and a depth of 236m, if measured from the Pit's surface to the exposed bottom layer ("**EBL**"). There are voids underneath the EBL, which have a thickness of approximately 100m. Taking into account the Pit's shaft and other voids below the visible EBL, the Pits depth is approximately 800m. The bottom of the Pit is clearly permeable, as no water retention is observed. The technical design of the backfilling of the Pit will indicate in which manner the Pit will be backfilled to avoid water seeping into the deep aquifer to contaminate the source. This will also include the blocking / plugging of shafts and side shafts to prevent tailings from entering them and sterilising the source. The source is currently used by JD in the Operation and it can therefore not be sterilised under any circumstances. The source was also used as a back-up water source for the Jagersfontein town before the Kalkfontein pipeline was constructed.

The Pit's walls, especially on the northern and north-eastern side, are susceptible to open jointing and toppling failures from time to time. The north west / south east trending fault that traverses the Pit is also susceptible to erosion, in the form of deep gulleys in the north west, and block failure.

The following indicates the regional and local setting of the farm and the Pit:

21 Digit Surveyor General Code for Portion 15:	**F01100000000001400015**

Coordinates of the corners of Portion 15:

Corner	Latitude (S)	Longitude (E)
A	29°45'36.48"S	25°24'56.63"E
B	29°45'40.56"S	25°25'17.16"E
C	29°45'42.54"S	25°25'16.74"E
D	29°45'43.26"S	25°25'18.60"E
E	29°45'51.06"S	25°25'23.82"E
F	29°45'59.16"S	25°25'19.86"E
G	29°46'1.62"S	25°25'17.40"E
H	29°46'4.80"S	25°25'10.02"E
I	29°46'1.50"S	25°24'53.52"E
J	29°45'53.34"S	25°24'52.98"E
K	29°45'46.02"S	25°24'54.12"E

The Pit's centre is located at the following coordinates:

	Latitude	Longitude
Jagersfontein Pit centre	-29° 45.852'	25° 25.152

Coordinates of the corners of the Pit:

No	Latitude	Longitude
1	29°45'43.15"S	25°25'1.63"E

2	29°45'42.39"S	25°25'5.49"E
3	29°45'43.37"S	25°25'12.91"E
4	29°45'45.90"S	25°25'17.24"E
5	29°45'51.69"S	25°25'19.29"E
6	29°45'56.03"S	25°25'16.68"E
7	29°45'58.82"S	25°25'9.65"E
8	29°45'57.84"S	25°25'6.77"E
9	29°45'55.48"S	25°25'2.87"E
10	29°45'50.22"S	25°25'0.06"E
11	29°45'46.51"S	25°25'0.69"E

Figure 1: Map indicating the locality of the existing gantry and shaft in relation to the Pit and Portion 15

The Site has no / very little vegetation inside, as it consists entirely of boulders / rocks. This includes the Pit's floor and sides. There is some vegetation in the area surrounding the Pit.

1.2 The Applicant

Applicant:	Jagersfontein Developments (Pty) Ltd
Postal address:	P.O. Box 263 Durbanville 7550

1.3 The Environmental Assessment Practitioner ("EAP")

EAP:	Turn 180 Environmental Consultants
Postal address:	Suite 221 Private Bag X01 Brandhof 9324
Contact person:	Louis De Villiers
Tel:	072 967 7962
E-mail:	louis@turn180.co.za

The project team:

Project Manager and EAP:	Louis De Villiers
Specialists:	
Geo-hydrology	GHT Consulting Scientists
Ecology and biodiversity	Mr. Darius Van Rensburg
Design Engineers	SRK Consulting

Heritage Specialist	To be included in the EIA Phase
Socio-economic specialist:	To be included in the EIA Phase

Refer to **Annexure 1** attached hereto for the expertise of the Project team to conduct the relevant studies.

2 Project description

2.1 Rehabilitation of the open historically mined pit

The Pit is currently in a serious state of degradation and very unstable, due to back-breaking of its sides / walls, which has and can result in associated vibrations in the area. JD seeks to rehabilitate the Pit to ensure safety to people. The Project will therefore consist of the Pit's rehabilitation, through filling it with fine and coarse tailings from the Plant that remain after processing of the Tailings Dumps and sand.

Dr. Howell, a geotechnical and structural engineer, was appointed to assess the Pit. He confirmed that filling the Pit with tailings it is the only viable way of ensuring its stability and eliminating potential risks to surrounding residents in the long term.

2.2 Existing infrastructure and services

The Site consists only of the empty Pit created by historic diamond mining activities. The Pit has a depth of 236m and a surface area of 19.635ha.

Save for a viewing deck, which has been closed by JD to the public and mine staff since April 2011 due to safety risks (on the recommendations of an engineer Rodney van Dam of MRH Consulting Engineer), no other infrastructure or services are located on the Site. The Shaft is located approximately 130m south of the Pit. Groundwater is abstracted from the Shaft by JD and is used only in the Plant. A mining museum was also established and is located within 100m to the north east of the Pit.

The conveyors, pipes and related infrastructure required to transport the tailings to the Pit will need to be constructed.

JD uses the Operational Site, which borders the Pit on all sides except its northeast and eastern side, exclusively for reprocessing the Tailings Dumps. The Operational Site has electricity supplied by Eskom and roads (built during historical mining activities), water supply resources (i.e. boreholes, dams and recycled water storage facilities), offices, the Plant, storage areas, the FTSF and workshops. The Plant is situated 400m metres to the south-west of the Pit.

The Jagersfontein Town residential area is located approximately 140m northeast of the Pit, with all infrastructure associated with a town. There are approximately 20 residential houses to the east outside of the main Jagersfontein Town, located between 150m to 350m away. The Historical Town Square (which has to a large degree been destroyed by fires during looting) is situated approximately 200m to the east. The access road to JD's Operational Site, a small guesthouse, two residential houses and a crèche are all located within 100m of the Pit.

2.3 New infrastructure and services

No additional buildings will be constructed for purposes of the Project, as the Tailings Operation's existing facilities around the Pit will be used.

The only major infrastructure to be constructed is a conveyor system and an eight inch (200mm) pipeline for the transportation of the fine and coarse tailings to and into the Pit. The pipeline's distance from the Plant to the Pit will be approximately 800–900m.

3 Property description

The Pit is located on Portion 15, which is 140m southwest of the Jagersfontein Town (refer to the locality map in **Annexure 2**). The Farm Jagersfontein is located in the Xhariep Karoid Grassland. This ecosystem is not listed as a threatened and protected Ecosystem under the National List of Ecosystems that are Threatened and in Need of Protection, published under the National Environmental Management: Biodiversity Act, No 10 of 2004 in GN 1002 of *GG* 34809 on 9 December 2011 ("**National List of Threatened and Protected Ecosystems**"). Portion 15 is 53.4552ha in extent and is the owned by JD. It is bordered by Portion 16 and the Remainder of the Farm Jagersfontein, owned by JD and the Kopanong Local Municipality respectively. The Tailings Operation's entire associated infrastructure is located on Portion 16 and the Remainder. Activities associated with the Tailings Operation mainly occur on the Remainder of the Farm Jagersfontein with other activities associated with the Tailings Operation occurring on Portion 16. The towns of Jagersfontein, Charlesville and Itumeleng are also situated on the Farm Jagersfontein 14/RE.

Due to the Pit's inaccessibility due to its vertical walls and its associated safety risks, no activities are currently undertaken on Portion 15, save for JD pumping water from the deeper aquifer at the 450m level from the Shaft. As noted, despite its heritage value, the Pit is too remote and neglected to be of interest to tourists and is currently closed to the public and mine staff due to safety issues.

There are no surface water features, including wetlands, located on Portion 15.

The prevalent wind direction in the area (determined from wind roses for Bloemfontein and Kimberley) is a northerly wind, which direction varies from north-eastern to north-western. As the Pit's Site is located to the south-south-west of the Jagersfontein Town, the Project will not have a major impact on the residents in terms of dust. Furthermore, the material discharged into the Pit will mostly be wet and will therefore not aggravate dust pollution.

3.1 Regional setting

Province:	Free State Province
District Municipality:	Xhariep Municipality
Local Municipality:	Kopanong Municipality

3.2 Zoning

The Department of Cooperative Governance and Traditional Affairs, Free State Provincial Government: Town Planning Division has confirmed that there is no town-planning scheme applicable to Jagersfontein. The Site has not been zoned for a specific land use and there is no legislation requiring this.

4 Project motivation

4.1 Legal requirement status

The aim of this section is to provide an overview of the legal framework and administrative requirements applicable to the licensing of the activity to ensure compliance with environmental requirements.

- **NEMWA**;

  The development involves an activity listed under the NEMWA as listed in the table below.

Number and date of the relevant notice	Activity No(s) in terms of the relevant notice	Description of each listed activity
GN. 581 29 November 2013	Category B: 8	The disposal of general waste to land covering an area of 19.635 ha with a total capacity exceeding 25 000 tons.

  A Waste License will thus be applied for according to the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).

- **NEMA;**

  A S&EIR process must be followed in terms of the 2014 EIA Regulations as amended in 2017 made under Section 24(5) of the NEMA to obtain a WML for the proposed activity as listed in the NEMWA listed activities.

- **National Environmental Management: Air Quality Act 39 of 2004 ("NEM:AQA");**

  The NEM: AQA is enforced to legislate and control emissions to the atmosphere. Although an Atmospheric Emissions License ("**AEL**") is not required for the activity a Dustfall monitoring programme in terms of the National Dust Control Regulation of 2013 under the NEM: AQA will be maintained throughout the lifetime of the project.

- **NWA**;

  In terms of Section 21(g) of the NWA a WUL should be obtained for the disposal of waste or water containing waste in a manner which may detrimentally impact a water resource. An application for this water use will therefore be submitted to the DWS.

- **NHRA**;

  The Pit is the biggest hand-excavated hole in the world and, given its historical value, is a heritage resource under section 3 of the NHRA. The Pit has, however, not been given any formal protection by the SAHRA or FSHRA under the NHRA. An Heritage Impact Assessment will be undertaken by a specialist to determine the historical value of the Pit and all findings will be communicated to SAHRA and the FSHRA.

4.2 Need and desirability of the Project

The Pit is geologically unstable, breaking back and poses vibration risks. The instability of the Pit poses a very serious safety risk, vitiating tourism opportunities and placing local residents at potential risk in the long term. JD appointed a geotechnical and structural engineering specialist, Dr. Howell, who has undertaken extensive and on-going assessments. The specialist has confirmed that the use of tailings for the Pit's rehabilitation is the only feasible, viable and practical way to ensure its stability and eliminate associated risks.

The Farm Jagersfontein is scarred from mining operations that have been conducted for over 100 years and is in a state of environmental degradation. Processing of the tailings dumps and backfilling them into the Pit is an environmentally sound project, which will lead to the land's rehabilitation. If there is sufficient Backfill Material available, the Pit will be backfilled to approximately 60m from the top so that the impact of the backfilling will be minimised on the shallow aquifer. If not, the majority of the Pit can still be backfilled and it will then be safe for the public as the walls will be more stable. In both instances Portion 15 can then be accessed and enjoyed by Community members and the public. This is clearly a far more sustainable use of the environment and such rehabilitation is in accordance with NEMA's principles.

4.3 Proposed Project

The Project will consist of rehabilitating the Pit on Portion 15, by filling it with fine and coarse tailings from the Plant after processing of the Tailings Dumps. JD seeks to rehabilitate the Pit to ensure safety to the surrounding people.

Due to its instability, the Pit is breaking back and has, and will, result in associated vibrations. Dr Howell, a geotechnical and structural engineer, was appointed to assess the Pit and has undertaken extensive assessments. He confirmed that filling the Pit with tailings is the only viable way of ensuring its stability and eliminating risks to surrounding residents in the long term.

As already noted the filling will be done by constructing a conveyor system to transport coarse tailings from the Plant to the Pit and constructing a pipe to transport the fine tailings to the Pit.

<u>The Project will benefit society in that:</u>

- it will restore the Pit's stability and ensure the safety of people in the area;
- the Pit's rehabilitation will ensure the long term safety of property and structures in the area;
- Contrary to its current state, the Pit can be put to good use. Currently, no land use activities are undertaken at the Pit. It is estimated that the Pit will be backfilled to a depth of approximately 60m from the rim of the Pit. Although this depth is not considered as safe measures can be taken to establish a new viewing platform on the edge of the Pit which can be used for public viewing. However, due to the depth at the end the Pit will have to remain fenced; and
- The Pit's rehabilitation will create employment opportunities for the people from the local community whom are currently employed at the Tailings Operations.

Negative aspects associated with the Project include the following:

- the Pit is a heritage resource under the NHRA, due to its important historical and archaeological value. This will be reduced post rehabilitation, as only the top part of the Pit will remain visible;
- it will sterilize any remaining mineral reserve (the "**Potential Reserve**"), which may be situated below the plug at the bottom of the Pit (the "**Plug**") and any future underground mining through the Shaft will become unfeasible, as the Potential Reserve will not be able to be accessed from the Pit's base. It would involve employees descending into the Pit to drill the Pit's base, as well as descending through the Shaft to blast and extract any kimberlite material at the deeper levels of the Pit. Such mining would however likely not be possible at present, given the extreme technical challenges and the health and safety risks associated with the blasting and drilling that would be required at the Plug and the Pit's base. The Plug is the material that is crucial to secure the stability of the Pit's walls. Mining of the Plug will likely increase the risks of the Pit's instability significantly, with the potential of the steep slopes falling into the Pit and the break-back extent being increased substantially. It is however not expected that any mining will occur at the Plug due to the severe safety risks; and
- the discriminated infilling of tailings may result in groundwater pollution in the deeper aquifer in the area.

5 Alternatives

5.1 Site Alternatives

Given the locality of the Pit and the Project, there are no alternative site locations.

5.2 Alternatives to backfilling

5.2.1 Fencing of the Pit

Positive attributes of the alternative

- The costs associated with this alternative will be much lower than to fill the Pit with tailings.
- There will be no groundwater pollution as is the *status quo*.

Negative attributes of the alternative:

- There is still a risk that people will be able to obtain access to the Pit;
- the existing environmental degradation will compound if the Pit is left as is; and
- to keep it in proper condition the fence will have to be maintained and repaired on a constant basis.

5.2.2 Civil Engineering Stabilisation Mechanisms

For the reasons below, this is not considered a viable option in the Scoping Report.

Dr. Howell investigated whether there are any civil engineering mechanisms that could be used to stabilise the Pit. His conclusion was that it is impractical to carry out any stabilisation work due to the geological circumstances present at the Pit. If it were possible, it would be a world first and the biggest endeavour of its kind in the world.

The difficulty with installing such stabilisation measures is that the area of potentially unstable ground on the Pit's north-eastern side (adjacent to the Jagersfontein Town) is 90m wide. The break back area is associated with a wedge of material, which extends to a depth of more than 200m. To stabilise this area would conceptually require rock anchors with a length of approximately 150m long, spaced 10m by 10m for a distance along the Pit's rim of some 320m ("**Proposed Anchors**"). That is a total of 320 anchors or 1280 anchors at a spacing of 5m by 5m. The length and number of anchors is not the problem but the physical size of the anchors that would be needed to restrain the weight of the unstable materials in the Pit's side walls. The physical and practical aspects of installing such anchors from within the Pit, with a sheer face of 300m, makes it impractical. Undertaking such a project is probably 100 times beyond present engineering capabilities (or two orders of magnitude). For example, the current highest building in Johannesburg is approximately 200m high. To build something that is two orders of magnitude higher would be 20, 000m high (20 km). This is impossible under the current engineering regime.

If it were possible to install anchors at the Jagersfontein Pit, to avoid affecting the Pit's rim, an aerial support system would need to be constructed over the top of the Pit, to allow access from the surface downwards in a safe manner. An extensive crane and related infrastructure would be required for this aerial support system to provide safe access. Even this would not be sufficient; shotcrete would be needed to bind the Pit's rim surface to ensure no loose rocks fall on people when they work below this level, using the aerial support system. This shotcrete layer would also affect the Pit's rim's appearance. Such project's costs, if it were possible, would exceed R500million.

Anchors were used at the DeBeers Pit in Kimberley to support the rim along the railway line in the 1970's The problem at this pit was on a completely different (very much smaller) scale and magnitude compared to the Jagersfontein Pit. The DeBeers Pit is also much shallower due to previous filling (60m compared to 300m for Jagersfontein). The objective in installing anchors at the DeBeers Pit was to support the railway line traversing across this Pit's edge but some 40m back from the rim. The anchors installed were similar to the design of the Proposed Anchors but much shorter (approximately 25m long) and were designed only to take the surcharge from the railway structure and not to support the DeBeers Pit's rim as their primary objective. Installing the anchors at the De Beers Pit was easy, as there was a ready bench on which to work. This is not available at the Jagersfontein Pit. Furthermore, as most of the De Beers Pit's rim is located in relative soft material, the slopes closer to the crest of the De Beers Pit's rim are much more gentle, which allowed easier access to install the anchors in the section of the pit rim close to the railway line. This is not the case at the Jagersfontein Pit.

However, within 10 years it was recognised that the anchors were ineffective and backfilling was needed to stabilise the De Beers Pit in the long term. Engineering structures are also not 'eternal' and have a design life of 50 to 100 years (depending on how much time and money is put into them). The design life of the DeBeers Pit's anchors is probably now close to being exceeded (the anchors were installed in the mid 1970's). Similarly, anything that is done at the Jagersfontein Pit (if it could be) would also be subject to a life span and reconstruction of some type would be required within approximately 50 years.

At the DeBeers Pit, the anchors have distressed themselves due to erosion around the anchors' heads and possible corrosion of the anchor wires themselves, so the lateral support system is no longer efficient. The decision to fill the De Beers Pit approximately 15 years ago is a more permanent solution to the problem that existed.

An estimated budget would be about half a billion rand, if it was possible to implement such anchors.

Possible man-made intervention to stabilise the Jagersfontein Pit would need to be the subject of an in-depth engineering design study to try and optimise the concept. But as a concept it is currently outside the realms of practicality.

5.3 Technological alternatives

The following alternatives in terms of technology and design were considered:

5.3.1 Lining

The Waste Classification and Management Regulations under NEMWA published in GN R634 of 23 August 2013 obligate waste generators and managers to dispose of waste to landfill in accordance with the Landfill Norms and Standards, which prescribe minimum engineering design requirements for the containment barriers for landfills used for the disposal of waste. As noted, the tailings constitute a Type 3 waste, for which a Class C landfill barrier system is required. A waste classification of the fine and coarse tailings indicated that it is a Type 3 waste in terms of the Landfill Norms and Standard**s**.

The infilling of the tailings into the Pit will therefore require the implementation of a Class C barrier system or liner. Due to the Pit's size and inaccessibility and the large safety risk of lining it, a liner of this type is unpractical, if not impossible. Even if it was possible, the costs of such lining would make it infeasible. The need to backfill the Pit due to safety risk clearly outweighs any need to line the Pit due to pollution risks. The Scoping and EIA Report will therefore not incorporate lining of the Pit as an alternative.

An application will be made in terms of section 74 of NEMWA for exemption from the application of the Landfill Norms and Standards.

5.3.2 Transportation of coarse and fine tailings to the Pit using vehicles

As an alternative, it was considered to transport the fine and coarse tailings with vehicles. This would entail the tailings being loaded onto trucks at the Plant after processing and transported to the Pit, where they will then be filled into the Pit.

Positive attributes of the alternative:

- This alternative might create job opportunities as truck drivers will have to be employed.

Negative attributes of the alternative:

- Vehicles travelling on gravel roads create dust, which will be a nuisance to both employees at the Tailings Operation and residents of Jagersfontein Town. The roads will need to be sprayed with water as a dust control measure. This is not a viable option as water is a scarce resource in the Jagersfontein area.
- The use of heavy vehicles, such as trucks, will increase the rate at which the roads disintegrate. Additional financial provision would have to be made for road maintenance and upgrades.
- Given the Pit's instability and the associated safety risks, trucks will not be able to enter the area around the Pit to offload the filling.

- To enter the Pit using vehicles will require an access road to be constructed with grades less than 10% for truck traffic. This will result in the construction of an access road of approximately 2 360m to access the depth of 236m safely. This will be a major construction project as very large volume of rock will have to be excavated and the footprint of the activity will increase. This option is therefore unpractical. Another possible access for vehicles includes an incline tunnel however, such a tunnel will require the same length for vehicular traffic and will be a major tunnelling exercise.
- Diesel costs for the trucks will be Extensive in comparison to the costs associated with the construction and operation of the proposed conveyor and pipeline systems.
- The increase in vehicles travelling with full loads on the roads at the Tailings Operation poses additional safety risks. This includes increased risks of accidents, fatalities, and unwanted spillages of diesel and tailings.

5.3.3 Inlet of pipe and conveyor location change

The preferred alternative for the inlet of the pipe and conveyer entails that the discharge point will move throughout the project and Backfill Material will be discharged from various points around the Pit as this will ensure better stability of the Backfilled Material.

The alternative to this is that a fixed point of discharge is made from where Backfill Material is discharged into the Pit. Although the alternative will result in less disturbance of the area surrounding the Pit it is imperative for JD to use the alternative which will result in better stability of the Backfill Material in the Pit. However, it should be noted that the area surrounding the Pit has been degraded by current and previous activities and the vegetation which will be disturbed when the preferred alternative is implemented will be limited as most of the surface area is cleared. The changing of the discharge point will therefore result in the Backfill Material being distributed inside the Pit more evenly.

5.4 No-go alternative

If the no-go alternative is decided on, the Pit will be left as it is and will continue be fenced off, to ensure safety as far as possible. Although this will not result in any negative environmental impacts, the opportunity to rehabilitate the Pit and ensure the safety of people, animals and property at the Jagersfontein will be diminished (refer to Sections 1.1 and 1.3 in this report).

6 Description of the receiving environment that might be affected and a description of environmental issues, potential impacts and cumulative effects

6.1 Geology and soil

Overview

The Pit and its immediate surroundings are located in the Da46 land type. The study area is underlain by the sandstone, mudstone and shale of the Beaufort and Ecca Group of the Karoo Sequence. However, the Pit is an empty void with only rocks forming the sides and floor of it. The stratigraphy of the local area comprises of sand, gravel and clay which is underlain by alternating layers of shale and dolerite (GHT, 2017).

The area is characterised by prismacutanic and pedocutanic B horizons (DEA, 2001). The amount of soil available in the Pit is minimal and cannot be utilised for agriculture due to the lack of soil available and safety reasons.

Geology and jointing of the Pit's walls has resulted in a near vertical sided void where some of the faces are more than 200m in height. The Pit's base is filled with debris from surface erosion overlying the waste rock from the block cave mining. The current level of the debris surface is at 236m.

Potential impacts	**Preliminary significance**	**Mitigation**
There will not be any impact on geology, as the Pit will be filled with tailings. No material will be removed from the Pit.	Low - With proper management and the implementation of best practices, the geological impact will be insignificant.	No material will be removed from the Pit. Backfilling will occur according to the engineer's specifications.
The area around the Pit may become disturbed and some soil might be lost. However, it is not anticipated to be in large volumes.	Low - No large volumes of soil will be removed from the area around the Pit.	Areas where the conveyor and pipe will be constructed will be cleared of topsoil (if any). Topsoil will be stockpiled to be used during the rehabilitation of the surface after the rehabilitation of the Pit is completed.
Cumulative impacts	**Preliminary significance**	
Negligible	Negligible	

6.2 Climate

Overview

Historical rainfall data received from the **DWS** indicates the Mean Annual Precipitation ("**MAP**") to be approximately 439mm / annum (DWS, 2018) at the Kalkfontein Dam, located approximately 19km north of the Pit.

Wind data indicates that the prevailing wind direction in the area is from the northeast to the northwest (refer to wind roses in **Annexure 4** for Bloemfontein and Kimberley).

The rehabilitation of the Pit will not have any impact on the climate of the area.

6.3 Air quality

Overview

Due to the fact that the Jagersfontein area has, save for the Tailings Operation, no major industrial facilities with atmospheric emissions, the overall air quality is good. The area is mainly associated with agricultural activities.

Potential impacts	**Preliminary significance**	**Mitigation**
The air quality may be negatively impacted by the tailings when they are transported and backfilled into the Pit. However, the impact from the tailings can be managed and reduced insofar by transporting them by pipe and keeping them wet when transporting via conveyor.	Low - If mitigation and management measures are implemented.	Fine tailings suspended in water will be transported through a pipe. Coarse tailings will be transported to the Pit via conveyor. Coarse tailings will be discharged from the Process Plant as damp/wet material. The Dustfall monitoring programme will continue to be implemented for the Tailings Operation to monitor additional emissions of dust.
Cumulative impacts	**Preliminary significance**	
No impact	None	

6.4 Groundwater

Overview

The geology of the Jagersfontein area consists mainly of sediments from the Karoo Supergroup. These are predominantly sandstone, shale and mudstones formations of the Dwyka-, Ecca- and Beuafort group, with intrusion of post Karoo dolerite sills and dykes along weak contact zones between different formations or fault zones.

The Karoo sediments are characterised by low permeability; groundwater movement mainly occurs along jointed and fractured zones caused by faults or on the contact zones with dolerite intrusions.

Based on the water levels around the Pit and the variability in water quality, it is evident that there are two aquifer systems in the study area. At the top is a shallow aquifer with a rest water level (water table level) of approximately 5m below ground level ("**mbgl**"). At the bottom is a deeper aquifer with a current drawdown water level at 417mbgl (5 March 2018) and a rest water level at approximately 160mbgl. The two aquifer systems are separated by an impermeable dolerite sill. This is based on early geological maps that indicate a dolerite sill from surface to depth of approximately 300m.

It is very likely that the dolerite sill is a major geological feature due to its thickness, the large area it covers over the Site and Operational Site and the important role it plays in the movement of groundwater in the study area.

The shallow aquifer will most probably be very recently recharged by rain water and will move along the weathered zone of the dolerite sill and / or fractures along the contact with the Karoo sediments that can be associated with the dolerite sill intrusion.

The aquifer systems are, to a large extent, independent of each other because of the impermeable sill that separates them. There may however be some isolated zones of connectivity between the two aquifer systems.

The surrounding groundwater users in the Jagersfontein Town abstract water from the shallow aquifer, as it is not feasible to drill boreholes to the depths required to abstract from the deeper aquifer. The shallow aquifer is not affected by the drawdown created in the deep aquifer. Abstraction from the deeper aquifer therefore has an insignificant impact on the shallow aquifer's water levels.

Because of the restricted movement of groundwater between the two aquifer systems, this will also be applicable to the movement of any undesirable chemical elements that may naturally occur in the deeper aquifer or from previous mining operations. JD is not conducting underground mining and the Tailings Operation will not directly impact on the deeper aquifer. Any undesirable chemical elements in the shallow

aquifer system, caused by the historical mining operations or the Tailings Operation, will similarly not migrate into the deeper aquifer. (Hoon, 2013).

The tailings also contain a high proportion of smectite clays. The smectite characteristics result in high water retention in the tailings. Water can be absorbed until the clay particles disperse, causing clay and fine particles to move downward in the profile forming clay lenses. This may give rise to low permeability layers, which can significantly restrict vertical infiltration.

However, if the tailings are backfilled into the Pit, they are compacted and enclosed and the development of low permeability layers will not be limited by erosion and preferential flow paths. In this environment, the surrounding aquifer permeability would be expected to be higher than the tailings. This is likely to cause most groundwater flow to be diverted around the backfilled pit. There is likely to be preferential flow of groundwater around the backfill rather than through it due to the lower hydraulic conductivity of the tailings backfill. The rate of leaching of salinity from the tailings is therefore likely to be much lower than the current situation at surface.

From literature, the surrounding rock permeability is generally higher than 10-6 m/s. Tailings permeability ranges from 10-9 m/s to 10-6 m/s. This may limit groundwater flow through the tailings plugging the pit.

The salt load that may be leached from the tailings into the groundwater, besides undergoing dilution, will be contained in the deep shaft waters and may not have a significant impact on the regional groundwater quality, as there is no link between the shallow and the deep aquifers.

Furthermore, it is only proposed that the Pit will be backfilled to a level of 60m below the surface which will further reduce the potential for impacts occurring on the shallow aquifer.

Potential impacts	**Preliminary significance**	**Mitigation**
Groundwater may become contaminated as a result of leaching of the water from the tailings after infilling thereof into the Pit. This will however only impact the deeper aquifer and not the shallow aquifer and, save for the use of the Shaft by JD, groundwater users in the region will not be impacted on.	Medium to high	Continuous monitoring of the water in the Shaft will be implemented to monitor the water quality of the resource and to determine the extent of pollution (if any). The Backfilling should be done according to specifications by the engineer.

The Shaft, from where groundwater in the deeper aquifer is abstracted, may be impacted on due to the infilling with tailings. This source will become sterilised if sludge extends to the Shaft and is not completely contained within the Pit. This water source was previously used for domestic use by the Kopanong Local Municipality, as a backup supply for the Jagersfontein Town during emergencies. Any potential for the Shaft to be a backup source will be lost after rehabilitation. At present, the Kopanong Local Municipality's main water source is the Kalkfontein Dam, with an alternative back-up source being Wolwas Dam. Since supply from the Kalkfontein Dam commenced in September 2012, the Municipality has not required the Shaft for backup water supply. The Shaft is furthermore no longer being used as a back-up supply by the Kopanong Local Municipality, as the water contains naturally occurring arsenic and the treatment plant is no longer operational. The Kopanong Local Municipality's equipment required to pump from the Shaft's lower levels is also dysfunctional and additional equipment would need to be installed to pump from the Shaft's deeper depths, which is necessary at present. This was the reason it used JD's pumps between 2010 - 2012. If the Kopanong Local Municipality decided again to use the Shaft	Medium	Continuous monitoring of the water in the Shaft will be implemented to monitor the water quality of the resource and to determine the extent of pollution (if any). The Backfilling should be done according to specifications by the engineer. It should be ensured that any openings in the walls of the Pit leading to the Shaft (if any) are closed.

as a back-up supply, which is unnecessary, it would require significant capital expenditure for new pumping equipment or reliance on JD's pumps again. The water treatment plant would also need to be refurnished to treat for the arsenic in the water. It was however proposed that some side shafts be blocked and sealed to preserve groundwater.		
Cumulative impacts There might be a cumulative impact on groundwater as a result of past and current operations. However, with the Pit's rehabilitation, the cumulative impact may be lower as it might not be used in future.	**Preliminary significance** Low	

6.5 Surface water

Overview

Jagersfontein is situated in the C51K quaternary drainage region of the Upper Orange Catchment.

The main surface water features on the Operational Site is Dam 10 with a capacity of 459, 126m^3; Loskop Dam with a capacity of 52,698m^3; and the watercourse that drains into Dam 10. However, the watercourse draining to Dam 10 is mostly dry.

It appears that Dam 10 was historically constructed as a pollution control dam as it is located on the lowest point of the entire Operational Site and water from the entire Operational Site collects therein. A previously submitted IWULA included an application for abstraction of water from this source.

Surface water from the Operational Site drains into the Proses Spruit, which will drain into the Wolwas Dam. These are not located on the Operational Site.

Potential impacts	Preliminary significance	Mitigation
There will not be an impact on surface water resources in the area as a result of the rehabilitation of the Pit as the surface level of the Pit after backfilling will be 60 m below surface.	No impact	The backfilling of the Pit will not extend higher than the surface of the surrounding environment.
Although it is not expected that there will be any impact on the quality of water in surface water resources there might be an impact on the quantity of water draining into the natural drainage areas as storm water may drain into the Pit from the surface of the surrounding environment as the surface is disturbed.	Low	Storm water will be diverted around the Pit to drain into the natural drainage lines and watercourses. Water will not be permitted to drain into the Pit from the surrounding environment. This will be done by implementing berms and/or trenches at the highest pint around the Pit.
The only impact which will occur is a positive impact on drainage and surface flow on the Operational Area of the tailings Operation as tailings will be removed from the surface and used as Backfill Material. The clearance of the tailings from the surface will result in better drainage of water on the Operational Area.	Positive impact	
Cumulative impacts This project is one-of-a-kind in the region and it is not likely to have a cumulative impact. However, the rehabilitation of disturbed areas will have a positive	**Preliminary significance** Positive	

cumulative impact on the region in terms of drainage of water as obstructions are removed from the surface. This will be done by removing the surface tailings dumps from the surrounding environment and using it to rehabilitate the Pit. The surrounding environment can then be sloped and rehabilitated at the completion of the project to improve drainage of surface water.		

6.6 Land use

Overview

Given the Pit's location and its associated safety risks, the Site's surface is not presently suitable for land use purposes. JD wishes to rehabilitate the Pit in order to restore the Site's land use potential. However, Portion 15 will never be used for any other land-use apart from tourism purposes as there will still be a 60 m deep void.

The rehabilitation of the Pit on Portion 15 will result in the rehabilitation of the surface area of the adjacent land where the Tailings Operation occurs. The surface tailings will be removed from the surface of the Operational Area. This will result in better opportunities for the land to be used for agriculture.

The Pit has heritage importance, as it is the largest hand-dug hole in the world. However, the Site does not receive visitors frequently due to its remote location, the safety risk it poses and the general lack of tourist facilities at Jagersfontein.

Potential impacts	**Preliminary significance rating**
The backfilling of the Pit will not have a small positive impact as the Pit will be more stable and will have more potential for tourism use. The site will be safer to access. As a result of the 60m deep void that will remain the site will however not be used for any other use (i.e. agriculture).	Positive impact
The rehabilitation of the Pit by backfilling will also result in the surface of the surrounding area being rehabilitated due	Positive

to the tailings being removed and backfilled into the Pit. This will result in more land for agriculture.	
With the rehabilitation of the Pit, the possibility to mine Potential Reserve from it will be lost forever. If there is a Potential Reserve, this will be irreversible as it will be sterilised. As noted above, mining any more diamonds from the Pit's plug has a very high safety risk and would be technically challenging.	The impact will be irreversible. However, the diamonds at the bottom of the Pit cannot be recovered economically.
The Pit is regarded as a heritage site, as it is the largest hand-dug pit in the world.	The impact will be low, as the Pit and the Jagersfontein Town are not visited frequently, as they are remote; the Pit poses safety risks and the general lack of tourist facilities at Jagersfontein. Post rehabilitation, the Pit's outer edge will nevertheless still be visible, as well as potentially the Pit's top portion if it is not completely backfilled, for any future visitors. The Site's heritage value thus will remain. The heritage authorities have not afforded the Pit or the Jagersfontein Town any formal protection and appear to have recognised that their heritage value is limited.
Cumulative impacts	**Preliminary significance**
A positive cumulative impact is that the Pit's rehabilitation might create land use opportunities for surrounding areas where there are currently none.	Minor positive, as this area is limited in extent.

6.7 Vegetation

Overview

The Pit is located in the Xhariep Karroid Grassland biome (Mucina and Rutherfort, 2006). This ecosystem is not listed as a threatened and protected ecosystem under the National List of Threatened and Protected Ecosystems or the Free State Nature Conservation Ordinance 8 of 1969.

There is very little to no vegetation inside the Pit, as it mainly consists of bedrock. The area surrounding the Pit has some vegetation, which has been disturbed by previous activities.

Potential impacts	**Preliminary significance rating**
No or very little natural vegetation will be removed, since very little still exists. The Pit is also not located in an endangered vegetation type.	Low
If the Pit is completely backfilled, the Pit's rehabilitation will have a positive impact on vegetation and ecology of the Site, as it will be revegetated.	Positive impact
Cumulative impacts	**Preliminary significance**
No cumulative impacts	Negligible

6.8 Animal life

Overview

As a result of the Pit's very steep and deep walls / rock faces mammals are incapable of entering the Pit. Therefore, there are not many animals in and around the Pit. However, it is possible that there are reptiles (i.e. snakes and lizards) in the area surrounding the Pit and birds inside the Pit. It should be noted that the area surrounding the Pit has been degraded as a result of the current tailings operation and that it is not expected that there are many animals present. After rehabilitation of the site (i.e. Pit and surrounding environment) it is expected that reptiles, insects, birds and other animals will return to the site.

The Tailings Operation has caused disturbance to habitats, which also impacts on the amount of animals around the Pit's surface.

However, post rehabilitation of the Pit and the Tailings Operation's completion, many species might possibly return to the Pit due to better accessibility and the ecosystem's development and improvement.

Potential impacts	**Preliminary significance rating**
The impact on animal life will be low due to the absence of animals in and around the Pit.	Low
Cumulative impacts	**Preliminary significance**
The rehabilitation of disturbed areas will create better habitats for animals	Positive

6.9 Cultural Heritage

Overview

The Pit was formed in the 1870s when Jagersfontein was proclaimed a public digging. It is the biggest hand-excavated hole in the world and, given its historical and archaeological value, is a heritage resource under section 3 of the NHRA. The Pit has however not been given any formal protection by the SAHRA or FSHRA under the NHRA.

Potential impacts	**Preliminary significance rating**
The Pit's heritage value will be diminished after rehabilitation. However, the Pit's significance as a heritage resource is restricted, as it seldom receives visitors. When balanced against the safety risks and the positive impacts of the Pit's rehabilitation, it is submitted that any resultant heritage impacts would be justifiable. Post rehabilitation, either the Pit's outer edge or the Pit's top portion will nevertheless still be visible for any future visitors and the Site's heritage value will remain.	Medium
Cumulative impacts	**Preliminary significance**
No cumulative impact.	Low

6.10 Noise

Overview

Jagersfontein does not have any industrial facilities / complexes apart from the Tailings Operation. The activities associated with the area are mainly agricultural. Therefore, noise pollution in the area remains low.

Potential impacts	**Preliminary significance rating**
The potential noise that may result from rehabilitation activities will be the same as the noise currently produced at the Tailings Operation. There is therefore no risk of an increase in noise pollution.	Low
Cumulative impacts	**Preliminary significance**
No cumulative impact	Negligible

6.11 Aesthetics

Overview

The area surrounding the Pit has been mined for over 100 years, is significantly degraded and has low visual significance. It is presently used for the Tailings Operation. This already significantly negatively impacts on the aesthetics of the area.

Given the safety risks, the Pit cannot be observed from a close proximity. However, after rehabilitation it will be possible to either a) observe the Pit's rim from close up, with the Site being rehabilitated in a manner which will improve the Site's aesthetics, by means of observing the Pit's top portion from a viewing platform.

Potential impacts	**Preliminary significance rating**
The rehabilitation will not negatively impact on the Site's aesthetics.	Positive
Cumulative impacts	**Preliminary significance**
No cumulative impacts	Insignificant

6.12 Demographics and Regional socio-economic structure

Overview

Jagersfontein population consists of 1 819 people. This includes the residents in Charlesville (490 residents) and the people residing on the Operational Site (40 people). There are 3, 910 people residing in Itumeleng.

Potential impacts	**Preliminary significance rating**
The Tailings Operation provides many jobs for local residents and also contributes to local businesses. Furthermore, JD assists in regular maintenance of Jagersfontein's service infrastructure by lending vehicles, equipment and other services to the Kopanong Municipality.	Major positive impact
The Project will ensure stability of the Pit's walls, which will minimise any potential injury to Jagersfontein's residents and damage to infrastructure in the area that could be caused by break back from the Pit and associated vibrations. As the Pit and Jagersfontein Town are currently not tourist attractions, there will be no loss of potential income from tourism for the Jagersfontein residents.	Positive
Cumulative impacts	**Preliminary significance**
Negligible	Negligible

7 Public participation during the scoping phase

7.1 Consultation process

Project initiation

A PPP under the EIA Regulations will be undertaken as part of the Scoping Phase, which will include the following:

- placement of site notices at various locations (i.e. library and post office) in Jagersfontein, the entrances to the Tailings Operation and the fence surrounding the Pit;
- placement of an advertisement in the local newspaper (i.e. Volksblad) and the Provincial Gazette;
- a notification and Background Information Document (**BID**) regarding the Project was sent to all identified interested and affected parties ("**I&APs**"). This includes the adjacent landowners and relevant authorities (refer to **Annexure 3**); and
- a public meeting will be arranged to receive comments from the Community and any other I&APs and to discuss the project.

A time period of 30 days will be allowed for the public to register and / or send their issues and concerns regarding the Project to Turn 180 Environmental Consultants Environmental.

Interested and Affected Parties / Stakeholders

Adjacent landowners and relevant stakeholders will be notified of the Project via written notifications, the BID and the Scoping and EIA Report. The main purpose of this is to inform the potential I&APs of the Project and obtain insight into any related issues they may have.

A comments and response register will be made and updated to include all comments received from I&APs. This register will also record the responses from the consultants and how comments are addressed.

Authorities

The following departments and / or organs of state will be consulted during the PPP:

- Department of Agriculture;
- SAHRA;
- FSHRA;
- DWS;
- DMR

- Free State Department of Economic Small Business Development, Tourism and Environmental Affairs ("**DESTEA**");
- Kopanong Local Municipality (Municipal Manager and Ward Councillor);
- Xhariep District Municipality.

Stakeholders

The BID, Scoping Report and EIA Report will be sent to the trustees of the Itumeleng Community Trust.

7.2 Register of I&APs / Stakeholders / Authorities contacted during the consultation process

Contact Person	Organisation	Contact detail	Manner of notification	Comments & Response
Authorities & Stakeholders				
Me. L.Y. Moletsane (Municipal Manager)	Xhariep District Municipality	051 713 9300 (Tel) 051 713 0461 (Fax) Private Bag X136 Trompsburg 9913 21 Louw Street Trompsburg 9913	Sent via registered mail on: 16/01/2018	No comments received.
Mr. M. Kubeka (Municipal Manager)	Kopanong Local Municipality	051 713 9200 (Tel) 082 304 4397 (Cell) 051 713 0335 (Fax) Private Bag X23 Trompsburg 9913 lebo@kopanong.gov.za	Sent via registered mail on: 16/01/2018	No comments received.
Municipal Ward Councillor: Ward 7	Kopanong Local Municipality	051 713 9200 (Tel) 082 304 4397 (Cell) 051 713 0292 (Fax) Private Bag X23 Trompsburg 9913	Sent via registered mail on: 16/01/2018	No comments received.

Contact Person	Organisation	Contact detail	Manner of notification	Comments & Response
Dr. Nthili	Department of Water Affairs (Free State) - Enforcement	051 405 9201 (T) 082 553 7200 (C) P.O. Box 528 Bloemfontein 9300 lenongp@dws.gov.za	Delivered by hand on: 16/01/2018	An email was received on 14/02/2018 from S. Mdhluli: DWS not to provide comment without specialist reports. From info on BID, DWS does not support infilling of pit because of water. Recommends testing of current water quality. Turn 180 will provide DWS with detailed Scoping and EIA reports. The Draft Scoping was sent to DWS on 12/04/18 with a letter to address the comments. The letter responded to the DWS comments as follows: • The applicant notes that detailed comments can only be provided after review of the report as it contains more information. • It was confirmed that the Pit does not contain any water. The Shaft contains water from the deep aquifer which is used in the process plant. Quality results of shaft water has been submitted to the DWS since commencement of monitoring. An engineer will develop a method of backfilling which will reduce the potential for seepage and contamination of groundwater in the deep aquifer. The engineer report to be included in EIA Phase. • A waste classification of the tailings (SRK Consulting) was done in 2016 and was submitted to the DWS as part of the IWULA. This report is most likely with another section in DWS. It is however attached to this Draft Scoping Report for review. The Geohydrological study is also attached. (Please refer to Annexure 3 for complete letter)

Contact Person	Organisation	Contact detail	Manner of notification	Comments & Response
Mr. P. Lerotholi	Department of Water Affairs (Free State) - Licensing	051 405 9000 P.O. Box 528 Bloemfontein 9300 lerotholip@dws.gov.za	Delivered by hand on: 16/01/2018	No comments received.
Mr. Jack Morton	Department of Agriculture	051 409 2624 (Tel) Landcare Building Glen Agricultural College Gielie Joubertstraat Glen 9360 P.O. Box 34521 Faunasig 9325	Sent via courier on: 16/01/2018	No comments received.
Mr. A. Salomon	South-African Heritage Resource Agency and FSHRA	021 462 4502 (Tel) P.O. Box 4637 Cape Town 8000	Submitted online on 24/01/2018	No comments received.
Me. G. Mkhosana	DESTEA – EIA Department	Private Bag X20801 Bloemfontein 9300 mkhosana@detea.fs.gov.za	Hand delivered on 16/1/2018.	No comments received.
Me. M. Sello	DESTEA – Waste Department	Private Bag X20801 Bloemfontein 9300 sellom@detea.fs.gov.za	Hand delivered on 16/1/2018.	No comments received.
Mr. A. Mulaudzi	Department of Mineral Resources	057 391 1300 (Tel) Private Bag X33 Welkom	Sent via registered mail on 16/1/2018	No comments received.

Contact Person	Organisation	Contact detail	Manner of notification	Comments & Response
	(Competent Authority)	9460		
Identified Interested and Affected Parties				
Mr. Lucas Dreyer (Adjacent Landowner)	Farm Nebo 313	083 388 1117 (Cell) 051 432 7624 (Fax) P.O. Box 13939 Noordstad Bloemfontein 9301 lucas@wgkconstruction.co.za	Sent via email on: 15/01/2018	No comments received.
Mr. P. Louw (Adjacent Landowner and member of farmers association)	Rietkuil 21/RE Commissiepoort 174	082 385 2007 (Cell) P.O. Box 163 Jagersfontein 9974 midkopsimbras@gmail.com	Sent via email on: 15/01/2018	No comments received.
Mr. Dennis Louw (Adjacent Landowner)	Vlakfontein 1173/1	082 717 4521 (Cell) P.O. Box 76 Jagersfontein 9974	Sent via registered post on: 15/01/2018	No comments received
Mr. Nelius Booysen / JJ Van Niekerk familietrust (Adjacent Landowner)	Preezfontein North 927 Preezfontein 19/RE	082 576 7877 (Cell) PO Box 50 Fauresmith 9978 cwk.booysen@gmail.com	Sent via e-mail on: 15/01/2018	No comments received.

Contact Person	Organisation	Contact detail	Manner of notification	Comments & Response
Mr. Marius Eksteen (Adjacent Landowner)	Vogelfontein 15	082 566 7771 (Cell) ria@diysuper.co.za	Sent via e-mail on: 15/01/2018	During a telephonic conversation Mr Eksteen acknowledged receipt of the BID and enquired on how the project will impact him and his property. Eko indicated that the activity will only occur on Portion 15 as this is the location of the pit. Mr. Eksteen indicated that he has no objections and no further interest in the project as long as there is no impact on his property.
Kopanong Local Municiplaity (Adjacent Landowner) Municipal Manager	Annex Preezfontein North 1063	051 713 9202 (Tel) 082 304 4397 (Cell) 051 713 0292 (Fax) Private Bag X23 Trompsburg 9913 lebo@kopanong.gov.za	Sent via registered mail on: 15/01/2018	No comments received.
Hugo Hamman (Adjacent Landowner)	Mara 205	0017 631 1789 (T) 079 888 4733 Hugo.hamman@sasol.com	Sent via e-mail on: 15/01/2018	No comments received.

Prospect Boerdery Trust Johan van Tonder (Sai Roux- swaer 082 876 5462)	Prospect 487	Postnet Suite 118 P/Bag X20097 Lydenburg 1120 johan.vantonder@glencore.co.za	Sent via email on: 15/01/2018	Registered as an I&AP with the following comments ON 14/2/18: Will there be any influence from nitrates/pollution into the groundwater? How will it be tested and controlled? When was the groundwater last tested? Where has it been tested? Can a copy of these tests be made available? Will the ground water be periodically tested in future? Do you intend lining the pit before backfilling it with the tailings? A response letter was sent to Mr. Van Tonder on 12/4/18 which indicated the following: • A short background of the 2 aquifers was discussed. • An engineer was appointed to design a method of infilling which will have no, or the least possible, impact on groundwater. Backfilling will occur according to his design. His design will entail that coarse tailings are used to line the Pit after which coarse and fine tailings are backfilled on top of it. This will ensure that no sludge seeps into the Shaft and will limit seepage of water into the deep aquifer. Although it is possible for water to seep into the deep aquifer from the Pit, all efforts will be made to prevent this and the Shaft's sterilisation as a water resource. Furthermore, if any groundwater pollution occurs it will be limited to the deep aquifer as the Pit will only be backfilled to a depth of 60mbgl (due to the volume of tailings available for backfilling). Due to the shallow aquifer's depth in relation to the depth of backfilling, it is not expected that any pollution of the shallow aquifer will occur. • Quarterly water monitoring is conducted, including the Shaft water which represents the deep aquifer. Turn 180 collects the samples which are submitted to the Institute for Groundwater Studies (Bloemfontein). This data is

Contact Person	Organisation	Contact detail	Manner of notification	Comments & Response
				logged and kept on file. It is available in the attached Geohydrological report. Monitoring will continue throughout the lifetime of the Tailings Operation. After closure of the operation monitoring will continue and the required frequency and duration will be re-assessed. • Lining of the Pit is unfeasible as it will be very expensive and poses major health and safety risks. The method of backfilling of the Pit, as developed by the Engineer, will involve "lining" the Pit's base as discussed earlier. The Draft Scoping Report and the letter to address his concerns was sent to Mr. Van Tonder on 12/4/18. Refer to the complete letter in Annexure 3 of the Report.
Jacobus Albertus Van Zyl Botha Testamentere trust (Botha) Rina Botha (Adjacent landowner)	Thomas 678/RE	083 455 1369 17 Voortrekkerstraat Fauresmith 9978	Sent via registered mail on: 15/01/2018	No comments received.
Gerrit Snyman (Adjacent Landowner)	Rust en Vrede 393/1 Thomas 678/1	082 435 7858 Brand Kraal 37 Brandkraal Jagersfontein 9974	Sent via registered mail on:15/01/2018	No comments received
Mr. Pieter Gabriel De Lange (Adjacent Landowner)	Waterval 329	083 687 7681 (Cell) 051 724 1013 (Tel) Skaarfontein PO Box 193 Jagersfontein 9974	Sent via registered mail on:15/01/2018	No comments received.

Contact Person	Organisation	Contact detail	Manner of notification	Comments & Response
Mr. Jacobus Rudolph Kolver (Adjacent Landowner)	Gamma 492 Paardeplaat A 964	051 722 2540 (T) 084 454 3454 (Cell) (dogter - Jorina Schlebush) PO Box 73 Fauresmith 9978 jorinasch@gmail.com	Sent via email on: 15/01/2018	No comments received

Gillian Vermaak	Itumeleng Community Trust	051 724 0259 (Tel and Fax) 082 355 1726 (Cell) gillian@glaasstudio.co.za PO Box 51 Jagersfontein 9974	Sent via e-mail on: 24/01/2018	Email received on 24/01/18 confirming receipt of notification. Registered as an I&AP. Enquired about opportunity to submit comments from other I&AP via herself. Commented their concern that the area not be left in an environmentally challenged state, posing a danger if only partially filled because of its depth. Eko responded by confirming registration as an I&AP. Also responded by saying that if representing a larger group through one representative, it will be easier, although. However, it is advised that all interested parties attend the meetings to raise comments and discuss the project. Proposed that comments be submitted after Draft Scoping Report as many concerns be already addressed therein. A response letter was sent to Mrs. Vermaak with the Draft Scoping Report on 12/4/2018. The letter indicated the following: • The Pit will only be backfilled to a depth of 60m below ground level due to the volume of tailings available to backfill the Pit. The filling of the bottom 176m of the Pit should stabilise the walls more than it is. Refer to Section 6.4 of the Draft Scoping Report which discusses the groundwater. • The proposed project was considered in order to rehabilitate not only the Pit, but the surrounding operational area through the removal of the surface tailings. The surrounding environment will have a better potential to be used for agriculture when the remaining surface tailings are used for backfilling of the Pit.

8 Plan of study for the Environmental Impact Assessment

8.1 Assessment Methodology

The main objective of the EIA process will be to assess and quantify the potential impacts that were identified by the Project team, specialists and I&APs during the Scoping study.

The concept of "significance" is at the core of impact identification, evaluation and decision-making during the EIA process and can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. intensity, duration and likelihood), while impact significance is the value placed on the change by different affected parties (i.e. level of acceptability) [DEAT (2002) Impact Significance, Integrated Environmental Management, Information Series 5].

The significance is rated from Low to High, as indicated in the table below. The table includes an explanation of the impact magnitude and a guide that reflects the extent of the proposed mitigation measures deemed necessary.

Significance	**Low**	**Low-Medium**	**Medium**	**Medium-High**	**High**
Impact Magnitude	Impact is of very low order and therefore likely to have very little real effect. Acceptable.	Impact is of low order and therefore likely to have little real effect. Acceptable.	Impact is real, and potentially substantial in relation to other impacts. Can pose a risk to I&AP.	Impact is real and substantial in relation to other impacts. Pose a risk to the I&AP. Unacceptable.	Impact is of the highest order possible. Unacceptable. Fatal flaw.
Action Required	Maintain current management measures. Where possible improve.	Maintain current management measures. Implement monitoring and evaluate to determine potential increase in risk. Where possible improve	Implement monitoring. Investigate mitigation measures and improve management measures to reduce risk, where possible.	Improve management measures to reduce risk.	Implement significant mitigation measures or implement alternatives.

The assessment criteria as mentioned above can be described as follow:

The **nature of impact** is a broad indication of what is being affected and how.

Severity relates to the nature of the event, aspect or impact to the environment and describes how severe the aspects will impact on the biophysical and socio-economic environment.

Type of criteria	8.2 Rating				
	1	2	3	4	5
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant / Non-harmful	Small / Potentially harmful	Significant / Harmful	Great / Very harmful	Disastrous Extremely harmful
Social / Community response	Acceptable / I&AP satisfied	Slightly tolerable / Possible objections	Intolerable / Sporadic complaints	Unacceptable / Widespread complaints	Totally unacceptable / Possible legal action
Irreversibility	Very low cost to mitigate / High potential to mitigate impacts to level of insignificance / Easily reversible	Low cost to mitigate	Substantial cost to mitigate / Potential to mitigate impacts / Potential to reverse impact	High cost to mitigate	Prohibitive cost to mitigate / Little or no mechanism to mitigate impact Irreversible
Biophysical (Air quality, water quantity and quality, waste production, fauna and flora)	Insignificant change / deterioration or disturbance	Moderate change / deterioration or disturbance	Significant change / deterioration or disturbance	Very significant change / deterioration or disturbance	Disastrous change / deterioration or disturbance

Extent refers to the spatial influence of an impact. It will be: a) local (extending only as far as the activity, or limited to the site and its immediate surroundings); b) regional (will have an impact on the region) c) national (will have an impact on a national scale); or d) or international (impact across international borders).

Rating	Description
1: Low	Immediate, fully contained area
2: Low-Medium	Surrounding area
3: Medium	Within boundary of operation
4: Medium-High	Beyond the boundary of the operation (locally / within the community)
5: High	Regional, National, International

Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken.

Rating	Description
1: Low	Once a year or once / more during operation / Life of Mine
2: Low-Medium	Once / more in 6 Months
3: Medium	Once / more a Month
4: Medium-High	Once / more a Week
5: High	Daily

Probability considers the likelihood of an impact/incident occurring over time.

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention, e.g. remedial action, takes place.

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

Should any fatal flaws be identified during the EIA process, which will be indicated by a “high” significance rating, the activity relating to the potential impact will be assessed as a “no-go” alternative (i.e. be excluded from the Project) if the impact cannot be managed and / or mitigated to acceptable levels.

8.3 EIA Process

8.3.1 Tasks anticipated for the EIA process

The list below is a summary of the tasks that will be undertaken as part of the EIA process and the manner in which they will be undertaken.

1. Conduct a baseline assessment at the Site and the Operational Site to determine the potential impact on the various spheres of the receiving environment;
2. Consult with the SAHRA on the appointment of a suitably qualified professional to assess the Pit's heritage value in terms of the NHRA and submitting a permit application;
3. Conduct a geo-hydrological investigation to determine potential groundwater impacts;
4. Conduct a geotechnical investigation to determine the properties of the coarse and fine tailings, the properties of the area required for construction of plant, the compaction properties of local material to be used for berms, embankments, roads, cut-off trenches, erosion protection facilities, diversion works, pollution control facilities, tailings facilities and other civil engineering facilities that may be required ; and
5. Compile a concept engineering design for backfilling of the Pit.

8.3.2 Consultation and public participation process

The PPP to be followed during the EIA process will include the following:

- continuous consultation with registered I&APs and the relevant Authorities;
- public meetings throughout the project for all registered I&APs;
- updating of the I&AP database throughout the consultation process in order to keep record of all I&APs contacted during the process;

- Copies of the Scoping Report, draft EIA Report (together with specialist reports and Environmental Management Programme) will be made available at a public space in Jagersfontein for public comment. All registered I&APs will be notified of the availability of the Reports and provided with a time period of 30 days to comment;
- a copy of these Reports will also be made available to the authorities for a period of 30 days for comment;
- compilation of a Comments & Response Report, that will include all comments received during the process (including comments received on any draft Reports) and the response taken by the EAP to address these comments where possible; and
- internal consultation with the DETEA in terms of the final design / layout of the Project.

9 References

- Hoon, G. J., 2013. *Impact Assessment of the Diamond Recovery Operation at Jagersfontein on Surface and Groundwater Resources.* Eko Environmental
- Mucina, L. & Rutherford, M.C. (eds) 2006. *The vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria
- Ochieng, L., 2016. *Waste classification and assessment of the tailings at Jagersfontein*. SRK Consulting (Pty) Ltd
- Van Niekerk, L, J., 2017. *Geohydrological study, Jagersfontein Mine*. GHT Consulting
- Whitcutt, N., 2012. *Application for the re-filling of the pit at Jagersfontein mine.* Nicholas Whitcutt Architects