# DE BEERS

#### DE BEERS CONSOLIDATED MINES LIMITED

APPLICATION FOR A PROSPECTING RIGHT: THE REMAINING EXTENT, SUBDIVISION 1 (KING'S PADDOCK) AND SUBDIVISION 16 OF THE FARM JAGERSFONTEIN NO. 14, MAGISTERIAL DISTRICT FAURESMITH

WORK PROGRAMME AS REFERRED TO IN REGULATION 7 IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT (28 of 2002)

REGIONAL MANAGER: MINERAL REQUILATION FREE STATE REGION

2010 -11- 30

DEPARTMENT OF MINERALS AND ENERGY PRIVATE BAG X33, WELKOM 9460

**APRIL 2006** 

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#### INTRODUCTION

The primary objective of the work programme is to locate and assess diamond deposits.

Kimberlite is a volcanic rock which occurs randomly and is not specific to any discrete host (country) rock lithology. Furthermore, because of erosion, kimberlites may have no surface expression and in many instances are hidden beneath surficial cover, which can reach tens of metres in thickness, and, thus, the detection thereof requires sophisticated methodologies and resources. Consequently, exploration programmes must be structured accordingly and commence with a reconnaissance sampling phase.

Prospecting for kimberlite is a dynamic results driven operation, which proceeds in phases, the outcome of which cannot be predicted or predetermined. Excepting the reconnaissance soil/stream-sampling phase, the scope of each subsequent phase is dependent on the results of earlier phases. The results of the reconnaissance sampling will indicate the areas over which the subsequent phases of work are required. These subsequent phases can include follow-up soil and/or stream sampling, geophysical surveys, drilling and first stage bulk sampling as well as activities such as detailed drilling, geophysical surveys and further bulk sampling to gather the additional information required in support of feasibility studies. The sites for the follow-up phases of work cannot be identified in advance nor can the phases be quantified in advance although some estimates are presented in this work programme.

Because of the time required to treat samples and to interpret their results, as well as to plan, schedule and resource the follow-up phases of work required, the phases of work will not follow directly after one another.

All personnel are fully trained and have wide experience of their duties and all work is undertaken under the direct supervision of a geologist.

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#### SECTION A:

#### PARTICULARS OF THE APPLICANT

Full name of applicant/holder:

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SECTION B:

PLAN OF THE LAND TO WHICH THE APPLICATION RELATES

The attached plan shows the area of land applied for.

SECTION C:

REGISTERED DESCRIPTION OF THE LAND TO WHICH THE APPLICATION

**RELATES** 

See Table 2, attached.

#### SECTION D:

THE MINERAL OR MINERALS TO BE PROSPECTED FOR

Diamond (DIA).

Diamond Alluvial (DA).

Diamond General (D).

Diamond Kimberlite (DK).

### SECTION E:

GEOLOGICAL DESCRIPTION OF THE LAND TO WHICH THE APPLICATION

**RELATES** 

The farm Jagersfontein 14 is situated on the Karoo Supergroup. The geology is mainly of the Adelaide Subgroup of the Beaufort Group in the northeast of the farm and the Tierberg Formation of the Ecca Group in the southwest. Both of these lithologies are intruded by an extensive Karoo dolerite sill. The Adelaide Subgroup is made up of blue-grey and purple mudstone inter-bedded with yellow sandstone and



siltstone, mudstone and sandstone. The Tierberg Formation is made up of blue-grey to dark grey shale with carbonate concretions, subordinate sandstone and siltstone in the upper part.

Two soil types are common in this area. The Hutton soil is common in the north while the Tierberg soil is more common in the south.

# SECTION F: DESCRIPTION OF HOW THE MINERAL RESOURCE AND MINERAL DISTRIBUTION WILL BE DETERMINED

(i) The prospecting work to be performed

De Beers RSA Exploration (De Beers) will conduct the prospecting work using its own staff and specialist contractors as required. This will be done in a phased approach with each phase dependant on the results of the previous one.

The first step in determining the presence and distribution of any mineral resource on the farm will be to locate kimberlites. This work will commence with a comprehensive review of all geological and geophysical information available on the farm to determine the correct techniques to be used in the search for kimberlites, in addition to the techniques that have been used already. Once a technique suitable geophysical technique for the area has been identified the area will be surveyed using that technique to define targets for initial drilling and/or minor excavating.

If kimberlites are discovered using these techniques, further drilling and/or minor excavating will be conducted to test them for economic potential.

Finally, bulk sampling (by means of large diameter drilling and/or excavations) of any potentially economic deposits would be required in order to define a mineral resource. If the results of bulk sampling were to be encouraging, a pre-feasibility study would be conducted in order to determine the viability of their economic exploitation. If warranted, mining feasibility studies will be initiated during which additional drilling and sampling may be undertaken to provide additional information for the studies. Experience has shown that it can take upward of 2 years to execute mining feasibility studies.

- (ii) Geochemical surveys to be carried out See above and sections G, H and I below for technical detail.
- (iii) Geophysical surveys to be carried outSee above and sections G, H and I below for technical detail.

Due to the dynamic nature of diamond exploration the work programme may have to be modified, extended or curtailed as results and data become available.

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# SECTION G: DESCRIPTION OF THE PROSPECTING METHOD OR METHODS TO BE IMPLEMENTED

Geophysical survey areas will vary between  $500 \times 500 \text{m}$  to  $4 \times 4 \text{km}$  depending on the inferred size of any target. Survey lines will be spaced at a maximum of 50 m and readings will be taken at a minimum of 5 m intervals along the lines.

# (i) Any excavations, trenching, pitting and drilling to be carried out

Should the prospecting techniques described above indicate that there could be kimberlites on the farm, excavations will be conducted to test for their presence and economic potential. Excavations (trenches, pits and drill holes) will be sited on a practical basis, in consultation with the people currently occupying the land. The dimensions of such trenches and pits shall be limited to the minimum required to achieve the desired results and within regulated specifications/standards.

#### (a) Trenching/pitting

Trenching and pitting are suited to resolving of any shallow anomalies that might be identified. The trenches would be oriented across the trends of any linear anomalies. The dimensions of the trenches and pits will be determined by the estimated thickness of surficial cover (overburden) over the body causing the anomaly, i.e. the thicker the cover, the deeper the excavation.

#### (b) Drilling

Percussion drilling (usually up to 165mm diameter) will be carried out on indicator mineral or geophysical anomalies to test for the presence of kimberlite. The holes may be vertical or inclined, usually at a maximum angle of 60 degrees. The borehole depth will be determined by the geologist and will depend on the type of anomaly and the geological conditions, including overburden.

Core drilling will only be conducted if kimberlite is discovered, with geological logging being one of the primary objectives of the exercise. The size of core drilled will be determined by such factors as cost, proposed core sampling, the degree of logging required and proposed geotechnical investigations. The orientation of core holes will vary depending on the drilling objective. In the case of delineation drilling, angled core holes will be drilled to give accurate kimberlite / country rock boundaries at depth. Vertical holes will be drilled for geological modelling and / or sampling of the core.

Core holes might be used as pilots for large diameter holes. The geological information provided by the core holes greatly reduces the risk of inappropriate Large Diameter Drilling (LDD) hole locations. Core holes allow for maximum control on information such as overburden thickness, likely



kimberlite intersections and therefore allow more accurate determinations of likely Large Diameter Drilling holes for diamond recoveries.

LDD, usually up to 450mm diameter, provides good geological and especially grade data. LDD will be conducted when grade assessment is one of the primary objectives of the exercise. The sizes of the boreholes drilled will be determined by such factors as cost, proposed sampling, availability of drilling machines, and the volume of sample required among others. LDD will take place after percussion and core drilling.

#### (ii) Any bulk sampling and testing to be carried out

#### (a) Bulk sampling

Bulk samples will be taken over any kimberlites that will be discovered in order to determine their diamond content. Material might be collected by trenching, pitting and drilling as described above. These samples might be used for the following:

#### (a-i) Micro Diamond Analysis (MiDA)

These samples will be taken for the purpose of proving the presence of diamonds (in this case those that are less than 0.5mm along 2 dimensions). A maximum of 200kg of kimberlite material per facies will be collected, either from bulk samples or from percussion or core boreholes.

#### (a-ii) Macro Diamond Analysis (MaDA)

Dependant on the micro diamond sample and other analytical results, bulk samples will be taken for the purpose of recovering diamonds that are larger than micro-diamonds. These MaDA results will then be used to estimate the macro grade of the kimberlite, to obtain an indication of the diamond size distribution and a preliminary indication of diamond quality. A minimum of 100 tonnes of kimberlite material will be collected per sample.

#### (b) Tests

#### (b-i) Petrographic Examination

Small samples (<2kg) collected from any type of excavation or borehole may be submitted for petrographic examination. Thin sections of the rock are prepared for microscopic description and interpretation by petrographers. Such work can classify the type of rock and its facies. This is useful in constructing a geological model of the kimberlite and is usually carried out in conjunction with the other types of tests described below.

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### (b-ii) Heavy Mineral Analysis (HMA)

These small samples (~5kg each) would be taken to determine the abundance of the indicator mineral grains and their size distribution within a particular kimberlite, or facies thereof. The chemistry of these indicator minerals may also be determined and interpreted in conjunction with petrographic observations.

### (b-iii) Physical properties of any kimberlites and their host rocks

Small amounts of material (<10kg) from excavations and core drilling will be used to carry out physical property tests such as density, conductivity and magnetic susceptibility. These tests will provide valuable information that might lead to the discovery of more kimberlites on the farms.

#### (b-iv) Geotechnical tests

Geotechnical investigations such as rock quality designation (RQD) and rock strength will be conducted on some of the drill core material. Core drilling will enable accurate geotechnical information to be collected that other forms of drilling will not allow. Additional data that can be obtained from core drilling include dips / bedding, hardness, alteration and faults / joints. Downhole geophysical surveying may also be used to support such logging, as well as to assist with general borehole logging.

## (b-v) Ore dressing studies

These are carried out in order to determine the treatment characteristics of the kimberlite to optimise production plant design.



#### SECTION H: PHASES OF THE PROSPECTING ACTIVITIES TO BE CARRIED OUT

Detailed in this section is a broad outline of the planned exploration work programme, in numbered phases, which should be read in conjunction with the summary and estimated costs presented in Table 1, as well as the timeframes, described in Section I.

- 1) Desk top studies and geological interpretation of all available geological data including any historic soil sampling data and any airborne geophysical and remote sensing data.
- 2) Target detection by means of geophysical surveying.
- 3) Desktop studies involving interpretation of the geophysical survey results in order to plan the next phase of work in detail.
- 4) Testing of targets
  - a) First stage small diameter (up to 165mm) percussion exploratory drilling and/or minor pitting and/or minor trenching, aimed at testing targets identified as being of interest, with the aim of proving the presence of kimberlite.
  - b) Processing of drill or rock samples for the various types of tests as required, such as petrography and physical rock properties.
- 5) Desktop studies involving interpretation of the initial drilling (or excavations) and testing in order to plan the next phase of work in detail.
- 6) Delineation and initial testing of kimberlite(s).
  - a) Detailed geophysical surveys over kimberlites, for delineation and borehole positioning purposes. This would be conducted using a variety of survey techniques such as magnetometry, electromagnetic methods and gravity.
  - b) Second stage small diameter (up to 165mm) percussion and core drilling and/or excavations, aimed at determining the extent of any kimberlite discovered and whether it has the potential to host diamonds. This involves collecting material for testing, such as further petrographic examination, HMA and MiDA. This stage could include downhole geophysical logging.
  - c) Processing of drill samples for the various types of tests as required.
- 7) Desktop studies involving interpretation of all drilling (or excavations) and test results, in conjunction with geophysical survey results, in order to plan the next phase of work in detail. Data available at this stage will be used to construct a

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geological model to allow for size estimation. All the above, combined with the thickness of overburden, micro diamond analyses, petrographic interpretations and mineral chemistry analyses will be used to assess the potential of any discoveries and therefore justification of any further work.

- 8) Bulk sampling (initial evaluation).
  - a) Carry out a bulk sampling programme to test for the presence of macrodiamonds. This may take the form of trenching or pitting or large diameter (up to 450mm) drilling. The number of excavations and/or boreholes and quantity of material to be collected will be based on the size of the kimberlite(s) and their internal geology such as facies variations.
  - b) Processing of macro-diamond samples to obtain a concentrate for diamond sorting in a dense-media separation (DMS) sampling plant.
  - Recovery of macro-diamonds from the concentrate to obtain an initial grade estimate at the diamond recovery laboratory in Johannesburg.
- 9) Based on a review of initial bulk sampling results and other information, the preliminary economic potential of the kimberlite(s) will be determined. Depending on the outcome of this, a larger bulk sampling exercise will be required to provide sufficient information for a pre-feasibility study.
- 10) Bulk sampling (evaluation sampling)
  - a) Carry out a bulk sampling programme in order to determine the economic potential of any kimberlite(s) discovered. This may take the form of trenching or pitting or large diameter (up to 450mm) drilling. Again, the number of excavations and/or boreholes and quantity of material to be collected will be based on the size of the kimberlite(s) and their internal geology such as facies variations. This programme will determine the macro-diamond content and quality to evaluate the economic potential of any kimberlite(s) discovered.
  - b) Processing of macro-diamond samples to obtain a concentrate for diamond sorting in a DMS sampling plant.
  - c) Recovery of macro-diamonds from the concentrate and the classification of these diamonds (in terms of size and quality) at the diamond recovery laboratory in Johannesburg.
- 11) Pre-feasibility study. Based on a review of bulk sampling results and other information such as the geological model and geotechnical information, the mineral resource will be defined and a decision made as to further work required.



- 12) Mining feasibility studies. Depending on the value of the estimated resource determined in Phase 15, a mining feasibility study may be conducted by a multidisciplinary team. This would include all relevant socio-economic and environmental impact studies, with the aim being to define mineral reserves and in support of an application for a mining right.
- 13) Supplementary drilling, sampling, geological modelling and ore dressing studies may be required to obtain additional information in order to finalise the mining feasibility study.

# SECTION I: TECHNICAL DETAILS OF PROSPECTING METHOD OR METHODS TO BE IMPLEMENTED AND TIMEFRAMES FOR EACH PHASE

The parameters, amount and timeframes for the work planned or estimated per phase are described below using the phase descriptions from Section H. This is summarised in Table 1.

- 1) Desktop studies and planning 1 month.
- 2) Target detection by geophysical surveying 9 ground gravity blocks 5 weeks.
- 3) Desktop studies involving interpretation of the geophysical survey results 2 weeks.
- 4) Testing of targets
  - a) First stage small diameter (up to 165mm) percussion exploratory drilling, with coring if required. The work required for this stage is estimated as 10 boreholes to 50 metres depth (total 500 m), with a total of 20 metres of coring if possible - 3 weeks.
  - b) Processing of drill or rock samples 2 months.
- 5) Desktop studies including interpretation of the initial drilling 2 months.
- 6) Delineation and initial testing of kimberlite(s).
  - a) Detailed geophysical surveys over kimberlites. This is estimated as one detailed block using a variety of techniques 4 weeks.
  - b) Second stage small diameter percussion and core drilling and/or small excavations. The work required for this stage is estimated as 8 boreholes to 50 metres depth (total 400m), with some coring as required 1 month.
  - c) Processing of drill samples 6 months.

- 7) Desktop studies involving interpretation of all drilling and planning of further work 3 months.
- 8) Bulk sampling (initial evaluation for presence of macro-diamonds).
  - a) Bulk sampling programme. This may be conducted by large diameter drilling or pitting, or a combination of both, in order to recover a total of 200 tonnes. Assuming that pitting is used, two pits of up to 7 x 6 metres (42 sq. m) plus ramps of 20 x 4 metres (80 sq. m) each will be required 2 months.
  - b) Processing of 200 tonnes of macro-diamond samples 3 months.
  - c) Recovery of macro-diamonds from 3000 kg of concentrate 4 months.
- 9) Review of results and planning 3 months.
- 10) Bulk sampling (evaluation sampling to obtain a parcel of diamonds for valuation).
  - a) Bulk sampling programme. This would be conducted by pitting, possibly supplemented by large diameter drilling. The quantity of material to be extracted would depend upon the results of the initial bulk sampling (phase 8). Assuming that only pitting is used and that 10,000 tonnes is required, ten pits of up to 20 x 8 metres (160 sq. m) plus ramps of 20 x 4 metres (80 sq. m) each will be required 4 months.
  - b) Processing of 10,000 tonnes of macro-diamond samples. Only a very rough estimate of the work required can be provided as this is highly dependant upon the characteristics of the ore 4 months.
  - c) Recovery and assessment of macro-diamonds. Only a very rough estimate of the work required can be provided as this is highly dependant upon the amount of concentrate generated - 12 months.

NOTE: Due to the phased nature of prospecting being dependent on information acquired in earlier phases, it is not possible to estimate quantities of work required beyond this phase. However, based on experience with past projects, rough estimates of duration to complete subsequent phases have been made. This work would be conducted in renewal periods beyond the original five year tenure of the prospecting right.

- 11) Pre-feasibility study 3 months
- 12) Mining feasibility studies minimum of 18 months including phase 13 as required.
- 13) Supplementary prospecting duration included in phase 12 above.



#### SECTION J: DOCUMENTARY PROOF

- (i) Refer to the information submitted under Regulation 5(h).
- (ii) Budget and De Beers' financial ability to conduct the proposed prospecting operations. Refer to the information submitted under Regulation 5(i).

#### SECTION K: APPROXIMATE EXPENDITURE PER PHASE

An estimate of the expenditure required for work on the property applied for is presented in Table 1. The figures are based on actual costs incurred during similar scaled projects and are summarised as follows, excluding the advanced work such as feasibility studies:

Total estimated expenditure for the five year period, up to and including Phase 11, un-escalated: R 8 086 991.

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#### SECTION L: UNDERTAKING TO ADHERE TO THE PROPOSED WORK PROGRAMME

I, the undersigned, hereby undertake to adhere to the work programme detailed in this application for prospecting for diamonds in the area described in Sections B and C.

Signed at ODHANNESBURG...on the 25 day of APRIL 2006

Signature of applicant

Name

SIPHOW. MOTOKENS

Capacity

EXPLORATION MANAGER - RSA.