

**Revised Final Rehabilitation, decommissioning and mine closure  
plan  
Including Environmental Risk Assessment  
Review October 2016  
Sizisa Ukhanyo Trading 830 CC  
Portion 1 Farm Lower Zwart Modder 79  
Remainder and Portion 2 Farm Upper Zwart Modder 78  
Remainder Farm Oup 80**

**Kenhard District**

**Reference: NC30/5/1/3/2/10455PR  
NC30/5/1/3/2/10358MP  
NC30/5/1/3/2/10610PR**

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# **1 INTRODUCTION**

## **1.1 Background**

The final rehabilitation, decommissioning and mine closure plans of all three operations were submitted in terms of regulations 53 and 54 relating to financial provision in the Mineral and Petroleum Resources Development Regulations, 2004 and approved as part of the Environmental Management Plans (EMP's). In terms of section 38B of the Mineral and Petroleum Resources Development Amendment Act, 2008 (Act 49 of 2008) (MPRDA) the EMP's is now deemed to have been approved, and an environmental authorisation been issued in terms of the National Environmental Management Act, 1998 (NEMA). In terms of the transitional arrangements of the Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations (NEMA Financial Regulation) that took effect on 20 November 2015 any actions undertaken in terms of regulations 53 and 54 relating to financial provision in the MPRDA Regulations, 2004 which can be undertaken in terms of a provision of the NEMA Financial Regulations must be regarded as having been undertaken in terms of the provision of these Regulations (Reg 17(1)). A financial provision approved in terms of the MPRDA Regulations, 2004 must also be regarded to be the financial provision approved in terms of the NEMA Financial Regulations (Reg 17(4)).

One of the conditions in terms of Regulation 17 (4) is that a holder that operates in terms of a financial provision approved in terms of the MPRDA at the time of the coming into operation of the NEMA Financial Regulations, must review and align such approved financial provision with the provisions of the NEMA Financial Regulations on an annual basis as set out in regulations 9 and 11, read with the necessary changes.

This document then serves to comply with regulation 11(1) of the NEMA Financial Regulations that states that the holder of a right or permit must ensure that a review is undertaken of the requirements for final rehabilitation, decommissioning and closure of the prospecting, exploration, mining or production operations at the end of the life of operations as reflected in a final rehabilitation, decommissioning and mine closure plan; and remediation of latent or residual environmental impacts which may become known in the future as reflected in an environmental risk assessment report.

The objectives of this final rehabilitation, decommissioning and mine closure plan is to to identify a post-mining land use that is feasible through-

- providing the vision (goals), objectives, targets and criteria for final rehabilitation, decommissioning and closure of the project;
- outlining the design principles for closure;
- explaining the risk assessment approach and outcomes and link closure activities to risk rehabilitation;
- detailing the closure actions that clearly indicate the measures that will be taken to mitigate and/or manage identified risks and describes the nature of residual risks that will need to be monitored and managed post closure;
- committing to a schedule, budget, roles and responsibilities for final rehabilitation, decommissioning and closure of each relevant activity or item of infrastructure;
- identifying knowledge gaps and how these will be addressed and filled;
- detailing the full closure costs for the life of project at increasing levels of accuracy as the project develops and approaches closure in line with the final land use proposed; and
- outlining monitoring, auditing and reporting requirements.

## **1.2 Issues that have guided the development of the plan**

Three approaches were employed to identify the key aims for the closure process that form part of the approved Final Closure Plan submitted and approved in terms of the MPRDA:

- Technical assessments which involved the recording of the project activities over the full life cycle of the mining operation (including closure) and the consequent potential impacts

on the environment (including cumulative impacts). This resulted in the compilation of a draft closure plan that facilitated discussions with the authorities as well as Interested and Affected Parties (I&APs).

- Identification and consultation with the relevant authorities to record their requirements as well as public meetings with I&APs to solicit/record their suggestions/issues/concerns.
- The collection of available/published environmental data, the review thereof for adequacy and hence the identification of the need for more comprehensive environmental studies/investigations and/or further information gathering.

Subsequent to the above activities/processes, advertisements of the operations were placed in local newspapers to notify I&AP's about the intended projects and invitations to register and participate in the consultation process. As a result of the consultation and recommendations from the environmental studies/investigations completed the company identified three key closure goals for the final decommissioning and closure of the mining operation that are listed below.

- To create a safe and healthy post-mining environment with no residual environmental impact.
- To create a stable, free draining post mining landform, which is compatible with the surrounding landscape
- To provide optimal post-mining social opportunities

Each goal is supported by a suite of key objectives and activities which are elaborated on in section 2 and 3 of this review. This review also describes how these objectives are planned to be met and elaborate on the implementation of certain risk mitigation actions (section 5). With risk assessment and mitigation being integral to the planning and executing of the rehabilitation and closure of the mine. Aftercare and maintenance of rehabilitated sites is often the difference between the ultimate successes or failure of rehabilitation and monitoring of rehabilitation will determine whether rehabilitation objectives and requirements are being achieved (section 3).

### **1.3 Context of the Mining and Prospecting operations**

#### **1.3.1 Mining Permits and Prospecting Rights**

The Bushmanland Granite core mining area one is situated over Portion 1 of the Farm Lower Zwart Modder 79, the Remainder and Portion 2 of the Farm Upper Zwart Modder 78 and the Remainder Farm Oup 80.

The operation is carried out under cover of two separate prospecting operations by means of Bulk Sampling. Within this area one mining operations are also taking place. The details of the three operations are as follow:

- Mining permit MP 017/2014 File reference NC30/5/1/3/2/10358MP issued to Sizisa Ukhanyo Trading 830 CC over 5Ha portion of Portion 1 Lower Zwart Modder No 79
- Prospecting right MPTR0 29/2015 File reference NC30/5/1/3/2/10610PR issued to Sizisa Ukhanyo Trading 830 CC over the Remainder Farm Lower Zwart Modder 79, portion of Portion 1 of the Farm Nous West 76, Remainder Farm Upper Zwart Modder 78 and a portion of the Remainder Farm Oup No 80.
- Prospecting right MPTR0 68/2010 File reference NC30/5/1/3/2/10455PR issued to Sizisa Ukhanyo Trading 830 CC over Portion 1 of the Farm Lower Zwart Modder No 79 and Portion 2 of the Farm Upper Zwart Modder 78.

As the operations share most of the infrastructure and technical resources this final rehabilitation, decommissioning and mine closure plan that include the environmental risk assessment is applicable to all three operations.

The operations are situated in the Namakwa District Municipality and Khai-Ma local authority of the Kenhardt administrative district of the Northern Cape.

Portion 1 of the Farm Lower Zwart Modder 79 and Portion 2 of the Farm Upper Zwart Modder 78 was registered in the name of Erna Claassens by virtue of deed T4340/2016. The portion on which the mining operations are situated has now been subdivided as Farm 444.

The Remainder of the Farm Upper Zwart Modder No 78 is registered in the name of the JHP van der Westhuizen Family Trust by virtue of deed T62357/2001. The portion on which the mining operations are situated has now been subdivided and consolidated with Farm 444 as Farm Zwartmodder Mountain No 445 and is in the process of being registered in the name of Jianqiang Su (ID 69051459494180)

Remainder of the Farm Oup 80 is registered in the name of Henque 1001CC by virtue of deed T46581/2001

The area is situated of the N14 main road 80Km east of Pofadder and 92Km west of Kakamas with an approximate locality Latitude S28.81571° and Longitude E19.67836° (Diagram 1&2).

### 1.3.2 Project Description

Dimension stone is a collective term for various natural stones used for structural or decorative purposes in construction and monumental applications. The defining feature of dimension stone is that unlike other mineral commodities which have value mainly as a result of their physical properties, the physical properties of a rock are merely the minimum qualification in determining whether it is fit for use in dimension stone applications. The ultimate success in marketing a natural stone as a dimension stone lies firstly in its appearance, and secondly in the possibility of producing rectangular blocks of suitable dimensions (hence the term dimension stone) to allow for successful production of the final product in the required sizes.

Dimension stone can be defined as “naturally occurring rock material cut, shaped or selected for use in blocks, slabs, sheets or other construction units of specialised shapes and sizes”. A dimension stone block thus has value as a result of its dimensions and appearance, underlain by a set of minimum physical properties (among these are various strength parameters, workability, ability to take a polish, and resistance to physical and chemical weathering) (Ashmole I, Motlounge M, 2008).

This defining feature, together with the set of minimum physical properties required has important implications in terms of the environmental impacts of dimension stone mining, as well as the management thereof. Indeed, when it is the intention to merely blast and remove stone for its physical properties (such as in crushed aggregate or ore mining), recovery can be almost 100% of the volume removed, while when the same stone is quarried with the intention of producing dimension stone blocks, recovery of saleable blocks is typically between 3% and 60%. This results in large quantities of waste rock which need to be disposed of, with resulting environmental implications.

The physical properties required of a successful dimension stone also have significant environmental implications – due to the requirement for inert materials which are not affected by weathering (and in today's context, the effect of severe chemically polluted atmospheric environments), dimension stone residues are typically benign from a pollution point of view. Like natural aggregates, dimension stone is used in its natural state, and does not require concentration and extraction from an ore. It is these latter two processes that result in significant environmental impacts such as acid mines drainage and other toxic effects associated with many of the metal extraction industries.

This mining operation can be classified as quarrying the open, or surface excavation of granite. Quarrying start from the earth's surface and maintain exposure to the surface throughout the extraction period. For both access and safety, the excavation usually has stepped or benched side slopes. Quarrying methods depend mainly on the desired size and shape of the stone and its physical characteristics and the main equipment used is diamond saws (Rotary saws). Diamond saws are large diamond-impregnated circular blades up to 2 m in diameter that are

used to form vertical cuts in the rock by moving the machine along a guideline or rail. Extremely accurate cuts can be made in this way. Wire saws are also used. These consist of several pulleys over which passes an endless carborundum or diamond-impregnated steel wire.

The project can be divided in three phases as follow:

- Construction, including the planning and implementation phases, creation of infrastructure, mine or pit footprint, access ramps and haul roads, waste, residue and product stockpiles, handling areas, water reticulation and electrical power.
- Operation, including daily activities, mine development and expansion.
- Decommissioning and Closure, including scaling down of activities ahead of temporary or permanent closure, cessation of mining or production, implementation of rehabilitation programme, monitoring and maintenance for prescribed period after cessation of operations; and closure, including completion of rehabilitation goals, application for closure, transfer of liability to the State and agreed post-closure monitoring or maintenance

a) Construction phase

The company has a lease agreement with the landowner for all logistical facilities like workshops and secure storage as well as accommodation that serves as the company HQ and only satellite logistics are provided at some of the quarries. The infrastructure areas will be discussed as part of the specific quarry in section 1.3.4 but will consist mainly of pre-fabricated buildings, mobile containers and temporary logistical facilities and no permanent infrastructure will be developed. Only existing farm tracks will be used and upgrading of the tracks will be done as part of the construction phase and maintenance as part of the operational phase.

b) Operational phase

Granite mining is depending on market demand for specific colors that can change within relative short period of time. Different quarries each with a specific color therefore needs to be available although not all of them will be active on the same time depending on the current market trend.

The separate quarries will be discussed section 1.3.4 but the mining method for all of them would be the same and consist of:

- The establishment of a flat floor through the use of diamond wire saws.
- The flat floor is then fitted with parallel rails which serve the rotary saws which cut blocks from the ore body with less waste than other systems. The saws have a diameter of 3-4m and for purposes of planning are deemed to have a cutting depth of 1.7m.
- The bottom of the blocks are separated by small diameter plug and feather technique.
- The raw cut block is lifted out of the hole and placed for transport by block carrying front end loader to the dressing area.
- At the dressing area, the block is neatened up through removal of any protuberances and the 1st grade blocks is then transported to the dispatch yard and the 2nd grade blocks to a separate stockpile area.
- Waste blocks and offcuts are transport by block carrying front end loader to the waste rock dump. Excavators are used to keep the top of the waste dump level to promote traffic ability.

c) Decommissioning and closure phase

Planning for closure and restoration from the beginning of an operation makes the process easier; waste can be removed as it is created, excavation can be planned so that topography restoration is less complicated, and topsoil soil can be re-use at shorter interval. Site rehabilitation can make the land more valuable and attractive for resale. Additionally, establishing a closure strategy (and communicating that activity to the public) can help enhance the company's reputation as a socially-responsible operation. The decommissioning and

closure phase at the end of the life of the mine will consist of implementing this final rehabilitation, decommissioning and closure plan.

### 1.3.3 Mine design map

The Springbok, Upington Main Road (N14) provide excellent access to the mining operation. The turn-off from the N14 to the mine headquarters of Sizisa is 46 km east of Pofadder.

High voltage power lines runs through some of the properties, and end-user electricity outlet is available but on some of the remote quarries electricity supply is by mobile generators.

Process and potable water is obtained from boreholes on the property with collection sumps for the recycling of process water used to cool the saws used for cutting of the granite blocks. Water is stored in a plastic tanks and or old farm reservoirs. Most of the logistics for all this operations is supplied at the company HQ that were developed as part of farm improvements and that will not form part of this final rehabilitation, decommissioning and closure plan in terms of section 44(c) of the MPRDA.

The location of the quarries per property will be discussed in the next sections and the design and quantification of the closure elements of each of the separate quarries will be discussed separately in section 7.

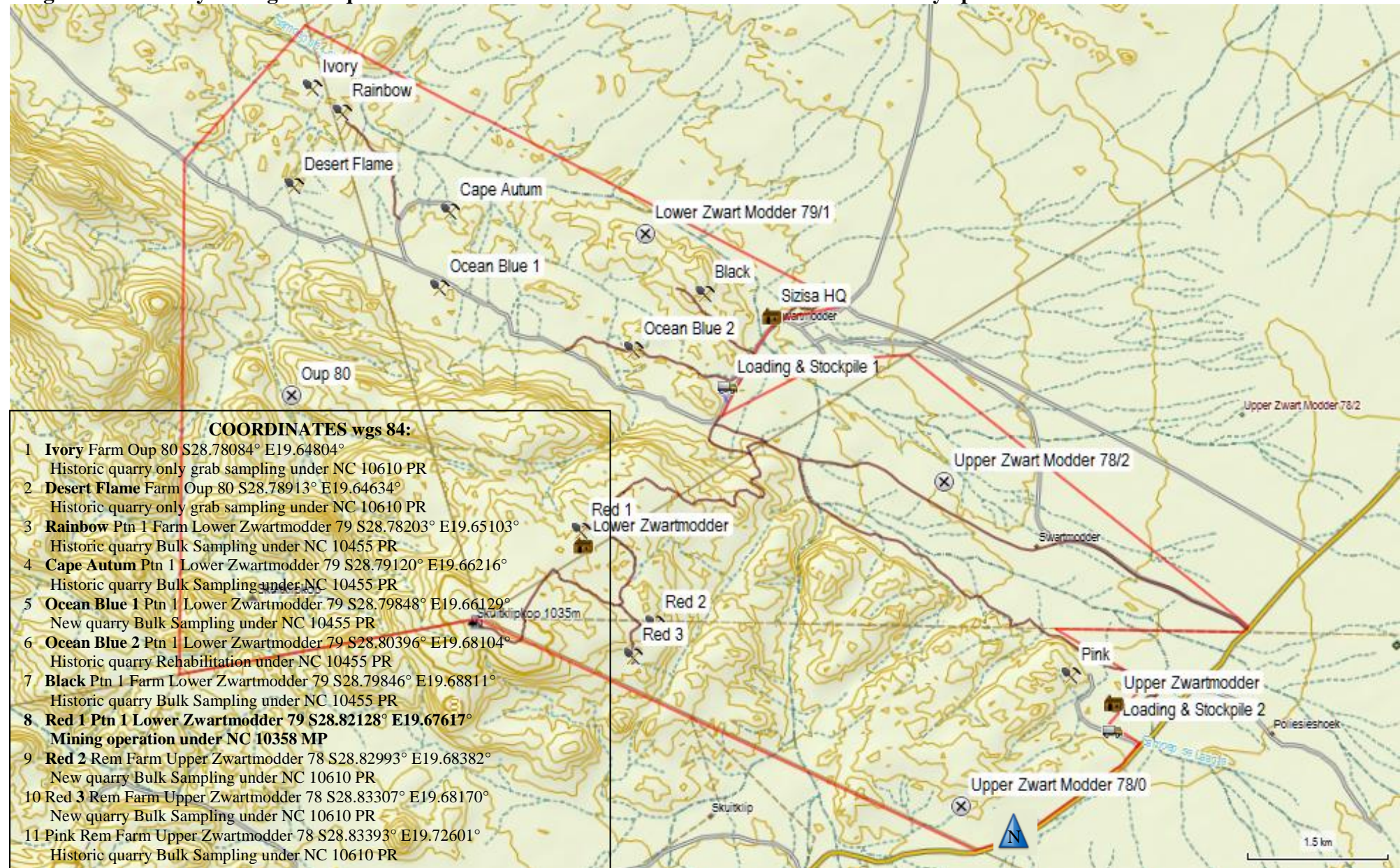


**Diagram 1: Core mining areas in relation to nearby business hubs and central logistical facilities of the Bushmanland Mining operations**





**Diagram 2: Locality of all granite quarries within core area 1 with infrastructure areas shared by operations**



#### 1.3.4 Project layout and development

##### a) NC-S 30/5/1/1/2/10610 PR Bulk sampling Remainder Farm Oup 80

The original prospecting area only consisted of the Remainder Farm Lower Zwart Modder 79 in extend 8675Ha and in September 2016 a 1311Ha portion of the Remainder Farm Oup 80 was added in terms of section 102 (Refer Diagram 3).

From 2017 prospecting work on this property will start and the following activities that are in line with the prospecting work program will be implemented.

- Reconnaissance of the whole prospecting area on foot and identifying areas with a good surface expression.
- Collecting of “grab samples” on the areas with a good surface expression excluding the two historic quarries “Ivory” and “Desert Flame” where information is available from the historic workings.
- Mapping and demarcating sample areas.

When this initial prospecting is completed it is envisaged that the largest section of this property will be relinquished by 2018 without any impact on the natural environment.

At this stage it is envisaged that the area retained for sampling will only include the Ivory and Desert Flame deposit but the following activities that are in line with the prospecting work program still needs to be implemented.

- Core drilling max .5m deep 38mm diameter
- Develop infrastructure and logistics
- Mine planning including waste dumps stockpiles and haul roads
- Cutting of bulk samples to determine quality and to test the market.

At the time of this review no invasive work has been completed and the development at any deposits identified for bulk sampling will be addressed as part of the next review of this final rehabilitation, decommissioning and closure plan.

With regard to initial prospecting the following will be applicable:

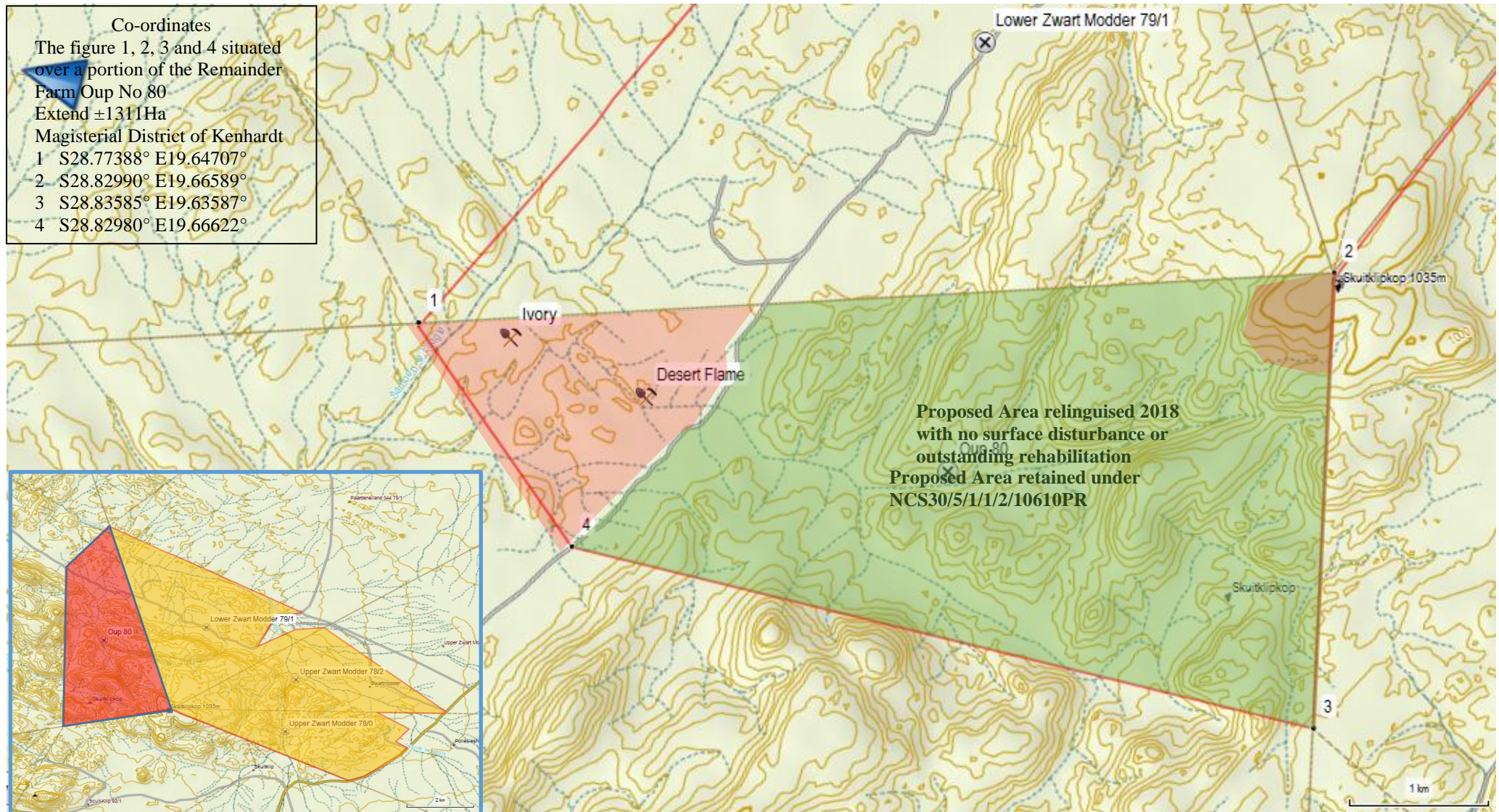
##### i. Infrastructure and logistics

- Access and service roads
  - The Springbok, Upington Main Road (N14) provide excellent access to the mining operation. The turn-off from the N14 to the mine headquarters of Sizisa is 46 km east of Pofadder.
  - Access from the HQ to the mine workings is via a dual use public road system and existing farm tracks.
- Services and associated infrastructure
  - During the initial phases of prospecting no services and associated infrastructure will be required and the operation consisting mostly of field investigations will be run from the company HQ.
- Accommodation and Logistics
  - The logistics to be used during prospecting will be available at the company HQ
  - Due to the temporary nature and small scale of prospecting operations no satellite logistics will be supplied.
- Waste management facilities
  - Due to the temporary nature and small scale of prospecting operations no satellite logistics will be supplied.
- Oil/grease/diesel management systems:
  - Due to the temporary nature and small scale of prospecting operations no satellite logistics will be supplied.
  - No machinery will be used during initial prospecting

- Surface disturbance
  - During initial prospecting only non-invasive activities will be implemented with no surface disturbance.
- ii. Quarry and Waste dumps
  - Opencast workings (including final voids and ramps)
    - During initial prospecting only non-invasive activities will be implemented mainly reconnaissance of the whole prospecting area on foot and identifying areas with a good surface expression.
    - Collecting of “grab samples” on the areas with a good surface expression excluding the two historic quarries “Ivory” and “Desert Flame” where information is available from the historic workings.
    - Mapping and demarcating sample areas.
    - Only after the results from initial prospecting is available can a decision be made with regard to the deposit identified for invasive sampling.
    - The development at any deposits identified for bulk sampling will be addressed as part of the next review of this final rehabilitation, decommissioning and closure plan.

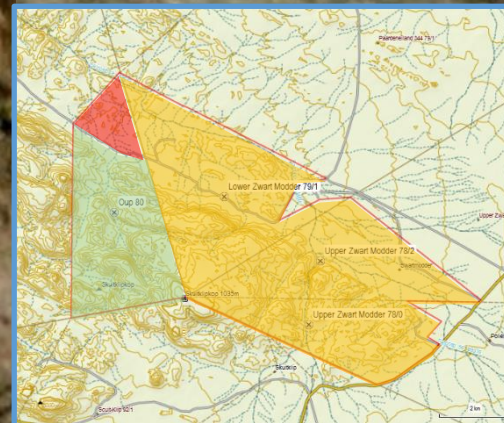
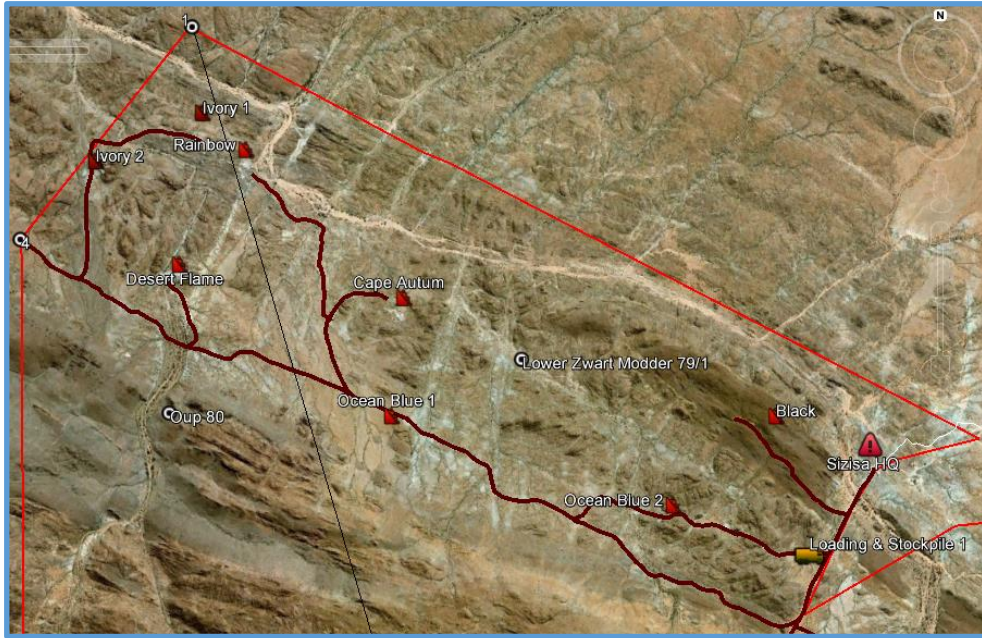


**Diagram 3: Locality of activities on the Farm Oup 80 NC-S 30/5/1/1/2/10610 PR**



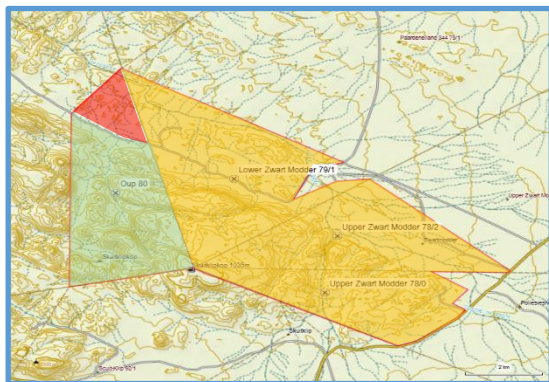


**Diagram 3a: Plan showing historic workings at Ivory Quarry on on the Farm Oup 80 NC-S 30/5/1/1/2/10610 PR as well as access from company HQ**





**Diagram 3b: Plan showing historic workings at Desert Flame Quarry on Farm Oup 80 NC-S 30/5/1/1/2/10610 PR as well as access from company HQ**



- b) NC-S 30/5/1/1/2/10610 PR Bulk sampling Remainder Farm Upper Zwartmodder 78  
 The original prospecting area only consisted of the Remainder Farm Lower Zwart Modder 79 in extend 8675Ha and in September 2016 a 960Ha portion of the Remainder Upper Zwart Modder 78 was added in terms of section 102 (Refer Diagram 4).  
 On this area three deposits were identified for sampling the Red 2, Red 3 to be managed as one operation and the Pink deposits. At this stage only preliminary planning of all three deposits has been done and the following activities that are in line with the prospecting work program will be implemented:
- Develop infrastructure and logistics
  - Mine planning including waste dumps stockpiles and haul roads
  - Cutting of bulk samples to determine quality and to test the market.
- With regard to the planned development on the quarries the following will be applicable:
- i. Infrastructure and logistics
- Access and service roads  
 The Springbok, Upington Main Road (N14) provide excellent access to the mining operation. The turn-off from the N14 to the mine headquarters of Sizisa is 46 km east of Pofadder. Access from the HQ to the mine workings is via a dual use public road system and existing farm tracks. Existing tracks will be used as haul roads and will only be upgraded to facilitate haul trucks.
  - Services and associated infrastructure  
 Process and potable water is obtained from boreholes on the property. All used process water will be collected in collection sumps for the recycling of process water to be used to cool the saws used for cutting of the granite blocks. Water is stored in plastic tanks. High voltage power lines are available for power supply to the Pink logistics area. Electrical supply required by the Red 2 & 3 logistics area and rock saws will be generated by mobile “gensets” to be supplied with generator bay and spill prevention measures.
  - Accommodation and Logistics  
 Most of the logistics to be used during prospecting will be available at the company HQ and at the two bulk sampling operations satellite logistics will be supplied and infrastructure, buildings and waste management facilities will consist of pre-fabricated buildings and mobile containers. Development of infrastructure and waste management facilities are still in progress and when fully developed the logistics area with waste management facilities will consist of the following:
    - Pre-fabricated buildings and mobile containers for site office and secure storage area.
    - Pre-fabricated buildings for personnel accommodation and amenities for the 10 to 15 people staying on site.
    - Waste management facilities
      - A demarcated laydown area for equipment prior to movement to the HQ.
      - A demarcated salvage yard for temporary storage of scrap prior to movement to the HQ.
      - Domestic waste will be collected in plastic containers and transported weekly to the HQ refuse site.
      - Petrochemical and hazardous waste including contaminated/used spares, filters and used oil will be collected and stored in special containers with spill containment measures and transported weekly to the HQ refuse site from where it will be dispose at a registered disposal site.



- Oil/grease/diesel management systems
- A service and wash bay needs to be developed and all grey water will be collected in a sump from where it is recycled.
- Bunded fuel supply and service apron needs to be developed with a sump for collection of spills and contaminated run off
- The generators needs to be supplied with generator bays with a sump for collection of spills and contaminated run off
- Contaminated soil and sludge from the collection sumps will be treated in a bio cell (soil farm) to be provided on site.
- Surface disturbance
- The stockpile and dispatch area for first grade blocks to be demarcated and the footprint contained.
- The sorting and dressing area together with stockpile area for low grade blocks to be demarcated and the footprint contained.
- Regular sorting and dispatch of blocks to be done as part of housekeeping.
- Blocks used for demarcation purposes to be removed to the demarcated waste dump.
- ii. Quarry and waste dumps
  - Opencast workings (including final voids and ramps)
  - Wire saws will be used to create a level surface to be fitted with parallel rails which serve the rotary saws which cut blocks from the ore body with less waste than other systems. The saws have a diameter of 3-4m and the average cutting depth of 1.7m. The bottom of the blocks are separated by small diameter plug and feather technique. The raw cut block is lifted out of the hole and placed for transport by block carrying front end loader to the dressing area.
  - Surface disturbance (compacted areas)
  - At the dressing area, the block is neaten up through removal of any protuberances and the 1st grade blocks is then transported to the dispatch yard and the 2nd grade blocks to a separate stockpile area. Except for dressing and sorting no processing is taking place but a relative large area still needs to be identified for the stockpile area.
  - Residue deposits overburden and spoils
  - The existing historic valley fill waste dump will be used at the Pink quarry and new Valley fill waste dumps will be created at the Red 2 and Red 3 quarries. Waste blocks and offcuts will be transport by block carrying front end loader to the identified waste rock dump. Waste rock will also be used to create a work platform for the extended quarry floor.

c) NC-S 30/5/1/1/2/10455PR Logistics & Access Portion 2 Upper Zwartmodder 78

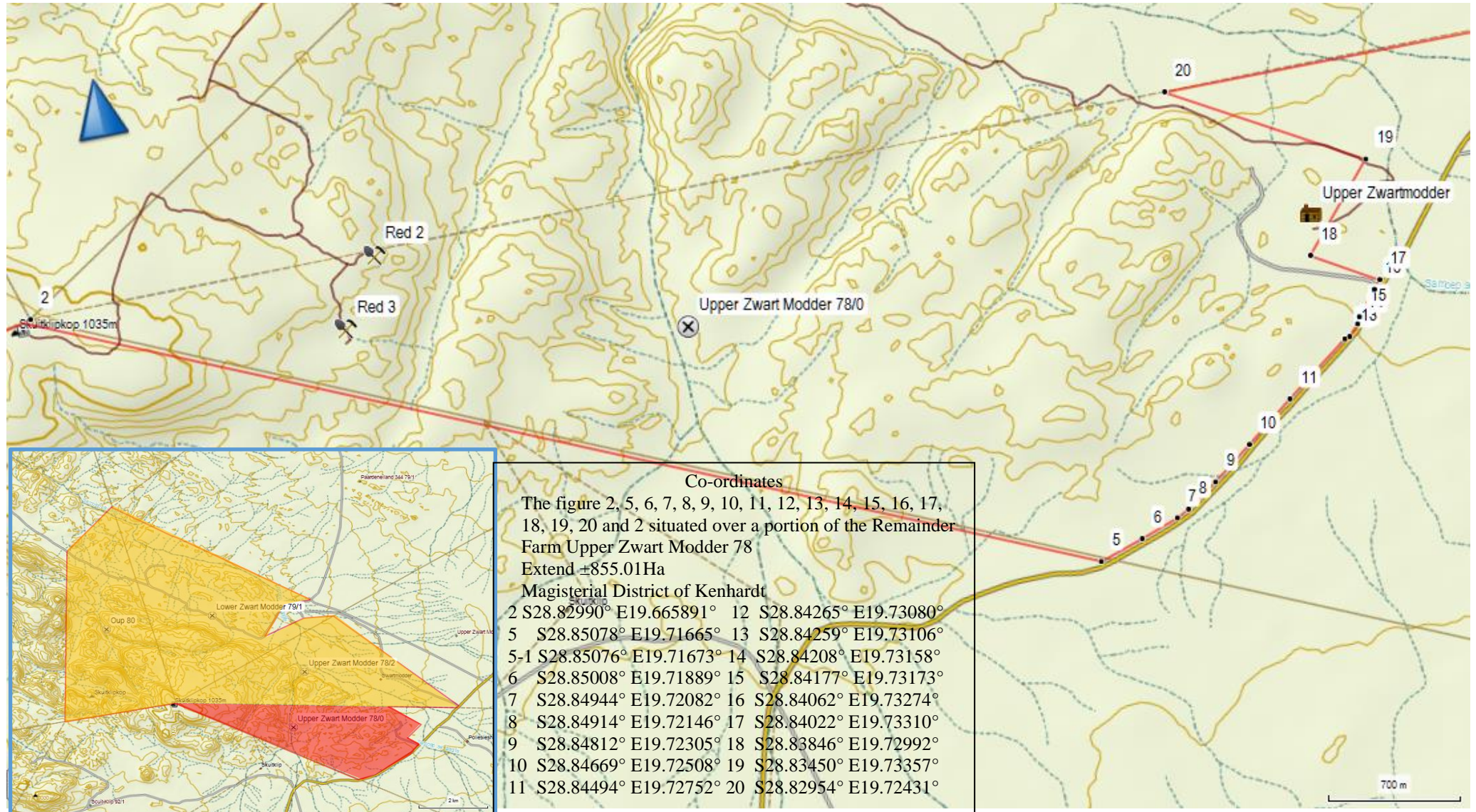
The original prospecting area consisted of the complete Portion 2 of the Farm Upper Zwartmodder 78 in extent 4467.5715 Ha (Refer Diagram 5).

From May 2008 to May 2010 prospecting were completed on this area. Only non-invasive field investigations were conducted making use of existing farm tracks and public roads therefore no rehabilitation were necessary and there were no impact on the natural environment.

From the initial work no deposits were identified for sampling and a large part of Portion 2 of the Farm Upper Zwartmodder 78 were relinquished (Refer Diagram 5). Only a small portion were retained for access and logistical purposes.

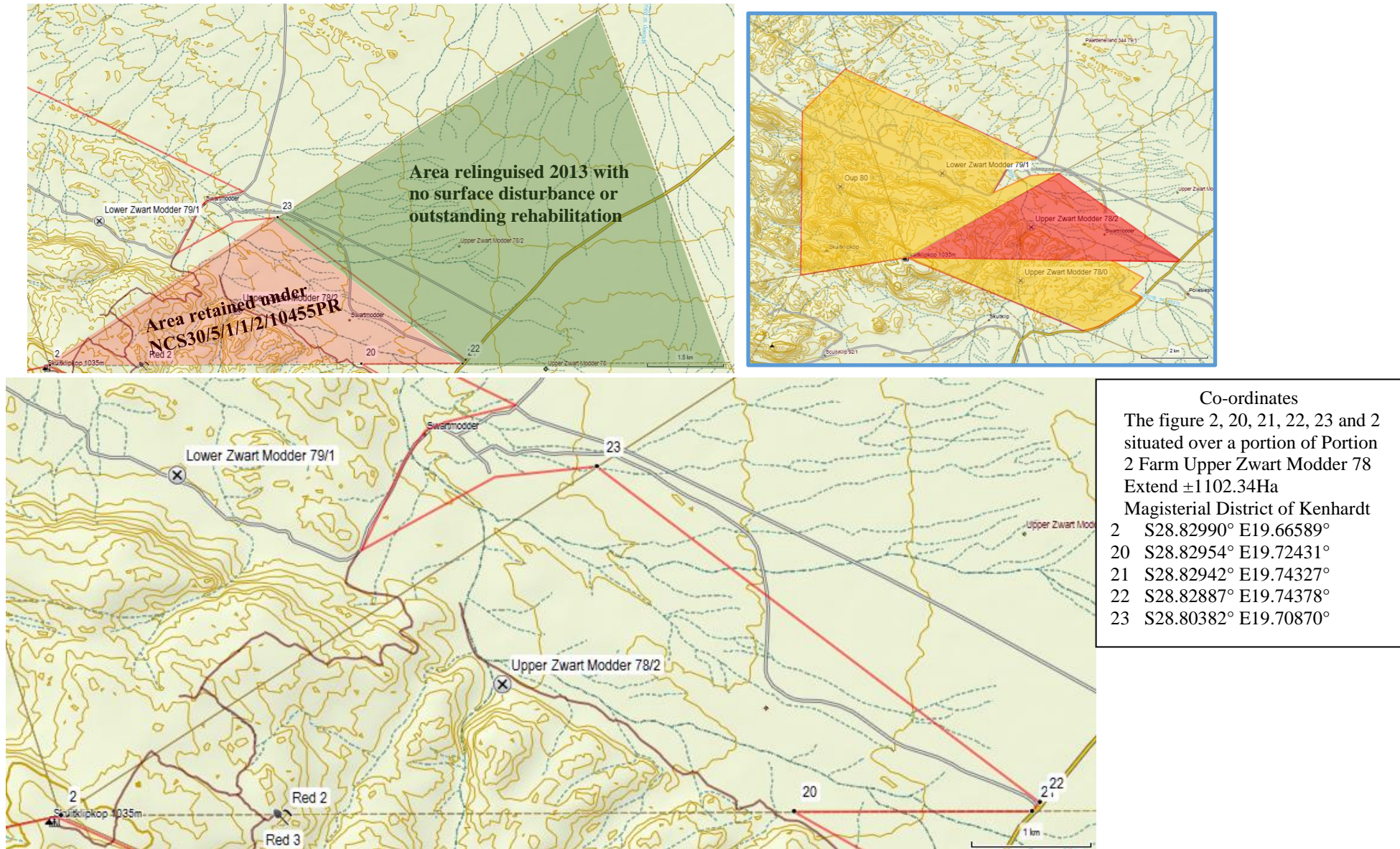
No further prospecting and mining is planned on this section and will only be needed to supply access and services to the rest of the mining operations. All services including electricity and water supply as well as access roads were developed as part of farm improvement and will not be demolished at final decommissioning in terms of section 44 of the MPRDA.

**Diagram 4: Locality of activities on the Remainder Farm Upper Zwart Moddr 78 NC-S 30/5/1/1/2/10610 PR**





**Diagram 5: Locality of activities on Portion 2 Farm Upper Zwart Modder 78 NC-S 30/5/1/1/2/10455PR**



d) NC-S 30/5/1/1/2/10455 PR Bulk sampling Portion 1 Farm Lower Zwartmodder 79

The original prospecting area consisted of the complete Portion 1 of the Farm Lower Zwartmodder 79 in extent 8662 Ha (Refer Diagram 6).

From May 2008 to May 2010 initial prospecting were completed on this area. Only non-invasive field investigations were conducted making use of existing farm tracks and public roads therefore no rehabilitation were necessary and there were no impact on the natural environment and a large part of Portion 1 of the Farm Lower Zwartmodder 79 were relinquished (Refer Diagram 6).

During 2011 to 2014 prospecting work on the remaining portion continued and the following activities that are in line with the prospecting work program were implemented.

- Reconnaissance of the whole prospecting area on foot and identifying areas with a good surface expression.
- Collecting of “grab samples” on the areas with a good surface expression.
- Mapping and demarcating sample areas.
- Core drilling max .5m deep 38mm diameter

On this property six deposits were identified as follow (Refer Diagram 6):

- Rainbow a Historic quarry planning still needs to be done as this is not a priority for the next 3 years
- Cape Autumn a Historic quarry earmarked for Bulk Sampling as a priority
- Ocean Blue 1 a new quarry earmarked for Bulk Sampling as a priority
- Ocean Blue 2 a Historic quarry where no further sampling is planned - This area needs to be rehabilitated as part of the annual rehabilitation plan
- Black a Historic quarry earmarked for Bulk Sampling as a priority
- Red 1 a Mining operation under NC 10358 MP – Refer 1.3.4 (e)

At this stage only preliminary planning of all deposits has been done and the following activities that are in line with the prospecting work program will be implemented:

- Develop infrastructure and logistics
- Mine planning including waste dumps stockpiles and haul roads
- Cutting of bulk samples to determine quality and to test the market.

With regard to the planned development on the quarries the following will be applicable:

i. Infrastructure and logistics

- Access and service roads

The Springbok, Upington Main Road (N14) provide excellent access to the mining operation. The turn-off from the N14 to the mine headquarters of Sizisa is 46 km east of Pofadder. Access from the HQ to the mine workings is via a dual use public road system and existing farm tracks. Existing tracks will be used as haul roads and will only be upgraded to facilitate haul trucks.

- Services and associated infrastructure

Process and potable water is obtained from boreholes on the property. All used process water will be collected in collection sumps for the recycling of process water to be used to cool the saws used for cutting of the granite blocks. Water is stored in plastic tanks. Electrical supply required by the logistics area and rock saws will be generated by mobile “gensets” to be supplied with generator bay and spill prevention measures.

- Accommodation and Logistics

Most of the logistics to be used during prospecting will be available at the company HQ and at the bulk sampling operations satellite logistics will be supplied and infrastructure, buildings and waste management facilities will consist of pre-fabricated buildings and mobile containers.

No development are planned at this stage at the Rainbow Quarry and the Cape Autumn and Ocean Blue 1 Quarry will share logistics due to their close proximity to each other. Development of infrastructure and waste management facilities still needs to be implemented as part of the construction phase and when fully developed the logistics area with waste management facilities will consist of the following:

- Pre-fabricated buildings and mobile containers for site office and secure storage area.
- Pre-fabricated buildings for personnel accommodation and amenities for the 10 to 15 people staying on site.

No development are planned at the Black Quarry due to its close proximity to the company HQ. Accommodation and Logistics at the HQ were developed as part of farm improvements and will not form part of decommissioning in terms of section 44(c) of the MPRDA. The facilities at the company headquarters are listed below and waste management are covered by this final rehabilitation, decommissioning and closure plan.

- Living quarters and personnel amenities
- Workshop with Eskom power supply
- Service and wash bay with pollution control measures
- Secure storage area and central supply stores
- Bunded fuel supply with service apron and fuel spill control measures
- Bio cell for bioremediation of any potential petrochemical pollution
- Laydown area for equipment and machinery not in use together with spares and accessories
- Salvage yard for redundant equipment and steel prior to sale to a scrap dealer
- Temporary waste storage area for hazardous and other waste
- Parking area (truck stop) for hauling trucks of transport service providers
- Centralised dispatch yard
- Waste management facilities
  - A demarcated laydown area for equipment prior to movement to the HQ laydown area.
  - A demarcated salvage yard for temporary storage of scrap prior to movement to the HQ salvage yard.
  - Domestic waste will be collected in plastic containers and transported weekly to the HQ refuse site.
  - Petrochemical and hazardous waste including contaminated/used spares, filters and used oil will be collected and stored in special containers with spill containment measures and transported weekly to the HQ refuse site from where it will be disposed at a registered disposal site.
- Oil/grease/diesel management systems
  - A main service and wash bay needs to be developed at the company HQ and all grey water will be collected in a sump from where it will be recycled.
  - Bunded fuel supply and service apron needs to be developed with a sump for collection of spills and contaminated run off
  - The generators needs to be supplied with generator bays with a sump for collection of spills and contaminated run off
  - Contaminated soil and sludge from the collection sumps will be treated in a bio cell (soil farm) to be provided on site.

- Surface disturbance
  - The stockpile and dispatch area for first grade blocks at the company HQ will be used for this operations and must be demarcated and the footprint contained.
  - The sorting and dressing area together with stockpile area for low grade blocks to be demarcated for each quarry and the footprint contained.
  - Regular sorting and dispatch of blocks to be done as part of housekeeping.
  - Blocks used for demarcation purposes to be removed to the demarcated waste dump.
- ii. Quarry and waste dumps
- Opencast workings (including final voids and ramps)
- Wire saws will be used to create a level surface to be fitted with parallel rails which serve the rotary saws which cut blocks from the ore body with less waste than other systems. The saws have a diameter of 3-4m and the average cutting depth of 1.7m. The bottom of the blocks are separated by small diameter plug and feather technique. The raw cut block is lifted out of the hole and placed for transport by block carrying front end loader to the dressing area.
- Surface disturbance (compacted areas)
- At the dressing area, the block is neatened up through removal of any protuberances and the 1st grade blocks is then transported to the dispatch yard and the 2nd grade blocks to a separate stockpile area. Except for dressing and sorting no processing is taking place but a relative large area still needs to be identified for the stockpile area.
- Residue deposits overburden and spoils
- The existing historic side hill fill waste dump will be used at the Rainbow quarry and the heap filled waste dump at the Cape Autumn Quarry. New Valley fill waste dumps will be created at the Ocean Blue 1 and Black quarries. Waste blocks and offcuts will be transport by block carrying front end loader to the identified waste rock dump. Waste rock will also be used to create a work platform for the extended quarry floor.



The map displays a topographic view of Portion 1 Farm Lower Zwart Modder 79. Key locations marked include Rainbow, Cape Autum, Black, Ocean Blue 2, Sizisa HQ, and Loading & Stockpile 1. A red line indicates the boundary of the farm. A blue box highlights a specific area, and a red line indicates the boundary of the farm. A scale bar shows 1 km.

**Area relinquished 2013 with no surface disturbance or outstanding rehabilitation**

**Area retained under NCS30/5/1/12/10455PR**

**Co-ordinates**

The figure 2, 23, 24, 25, 26, 27, 28, 29 and 1 situated over a portion of Portion 1 Farm Lower Zwart Modder 79 Extend ±1536.95Ha Magisterial District of Kenhardt

2	S28.82980° E19.66622°
23	S28.80382° E19.70870°
24	S28.80460° E19.70067°
25	S28.81005° E19.69007°
26	S28.80320° E19.69365°
27	S28.80115° E19.69513°
28	S28.80051° E19.69668°
29	S28.79924° E19.70232°
1	S28.77379° E19.64729°

e) NC-S 10358MP Mining Operations Portion 1 Farm Lower Zwart Modder 79

This mining operation covering an area of 5Ha is situated adjacent to the bulk sampling operation under NC-S 10455PR and this operations share most of the infrastructure and technical resources (Diagram 7).

i. Infrastructure and logistics

- Access and Haul Roads

The Springbok, Upington Main Road (N14) provide excellent access to the mining operation. The turn-off from the N14 to the mine headquarters of Sizisa is 46 km east of Pofadder. Access from the HQ to the mine workings is via a dual use public road system and existing farm tracks. Existing tracks will be used as haul roads and will only be upgraded to facilitate haul trucks by applying dust suppression and/or hardening compound such as Macadamite.

- Services and associated infrastructure

Process and potable water is obtained from boreholes on the property with collection sumps for the recycling of process water used to cool the saws used for cutting of the granite blocks.

Electrical supply for the logistics are supplied via an Eskom line but power supply to the rock saws are generated by mobile gensets supplied with generator bay and spill prevention measures.

- Accommodation and Logistics

Most of the logistics are available at the company HQ and at the quarry only satellite logistics are supplied and infrastructure, buildings and waste management facilities consist of pre-fabricated buildings mobile containers and/or structures created from waste blocks and upgrading of infrastructure and waste management facilities are still in progress. When fully developed the logistics area with waste management facilities will consist of the following:

- Mobile units for site office and secure storage area.
- Pre-fabricated buildings serves as personnel accommodation and amenities for the 15 people staying on site.
- Waste management facilities
  - A small demarcated laydown area for equipment prior to movement to the company HQ.
  - A small salvage yard for temporary storage of scrap steel prior to movement to the company HQ.
  - Domestic waste are collected in plastic containers and transported weekly to the company HQ refuse site.
  - Petrochemical and hazardous waste including contaminated/used spares, filters and used oil are collected and stored in special containers with spill containment measures for disposal at a registered disposal site.
- Oil/grease/diesel management systems
  - The service and wash bay at the company HQ are used.
  - The fuel supply tank is provided with a bund wall and service apron.
- Surface disturbance
  - The stockpile and dispatch area for first grade blocks at the company HQ are used.
  - Blocks used for demarcation purposes to be removed to the demarcated waste dump at final closure.



ii. Quarry and waste dumps

- Opencast workings (including final voids and ramps)

Only one floor were created at this quarry that is fitted with parallel rails which serve the rotary saws which cut blocks from the ore body with less waste than other systems. The saws have a diameter of 3-4m and the average cutting depth of 1.7m.

The bottom of the blocks are separated by small diameter plug and feather technique. The raw cut block is lifted out of the hole and placed for transport by block carrying front end loader to the dressing area.

A high wall were created as part of the development of this operation that needs to be addressed as part of decommissioning.

- Surface disturbance (compacted areas)

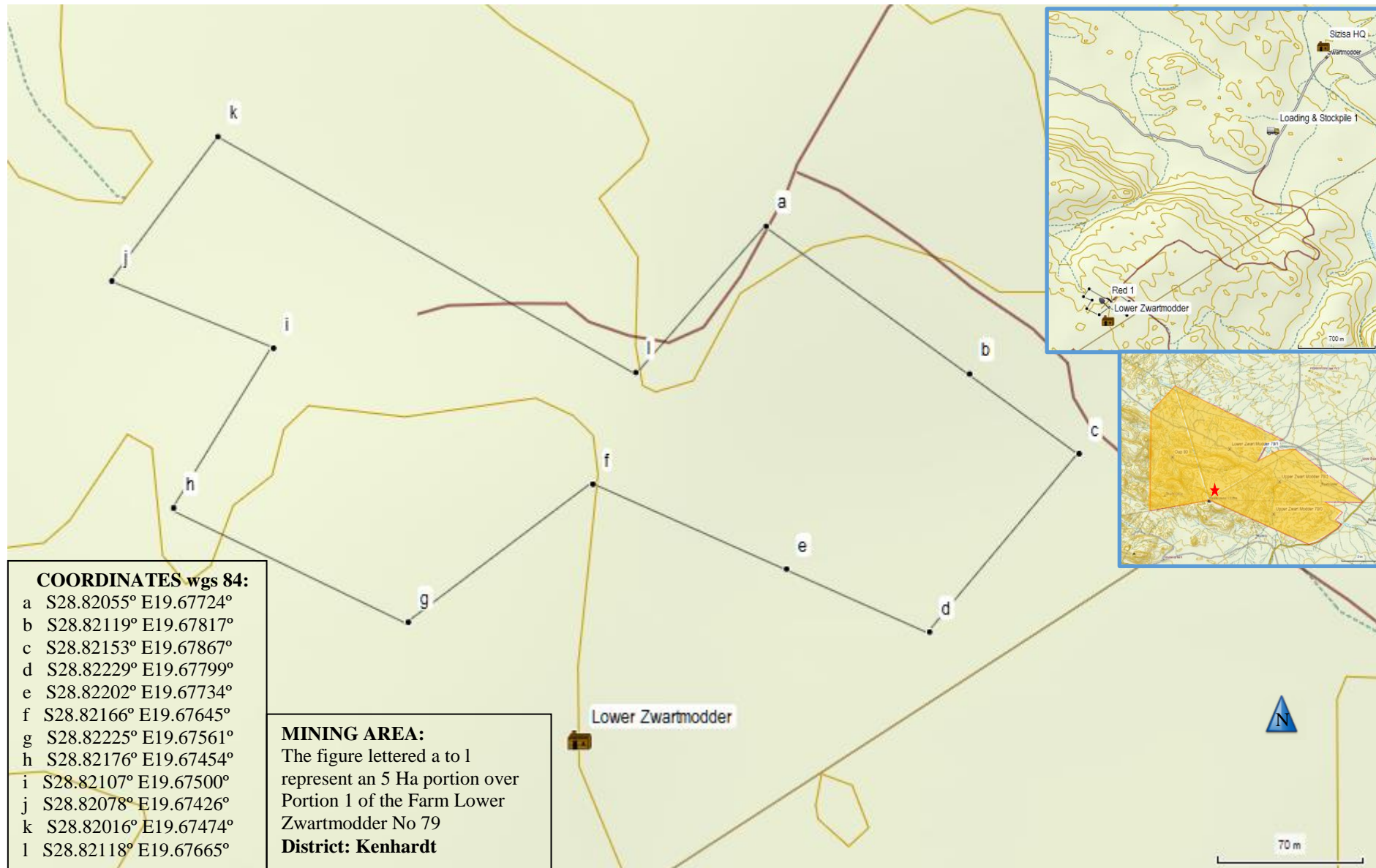
The surface of one of the valley filled waste dumps is used as dressing area where the blocks are neatened up through removal of any protuberances and the 1<sup>st</sup> grade blocks is then transported to the dispatch yard and the 2<sup>nd</sup> grade blocks to a separate stockpile area. Regular sorting and movement of blocks to the designated areas needs to be done as housekeeping.

Except for dressing and sorting no processing is taking place but a relative large area is taken up by stockpile areas as indicated on the diagrams below.

- Residue deposits overburden and spoils

Waste blocks and offcuts are transport by block carrying front end loader to the waste rock dump. When operations started three valley filled waste dumps were present but only one of the historic waste dumps will be used by this operation and all other waste dumps needs to be rehabilitated as part of the annual rehabilitation plan.

**Diagram 7: Mine layout NC 10358 MP - Red 1 - Ptn 1 Lower Zwartmodder 79**



## 2 REGULATORY REQUIREMENTS

The original Final rehabilitation, decommissioning and mine closure plans was submitted in terms of regulations 53 and 54 relating to financial provision in the Mineral and Petroleum Resources Development Regulations, 2004 and approved as part of the Environmental Management Plan (EMP) submitted for each of the operations separately.

In terms of the transitional arrangements of the Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations (NEMA Financial Regulation) that took effect on 20 November 2015 any actions undertaken in terms of regulations 53 and 54 relating to financial provision in the MPRDA Regulations, 2004 which can be undertaken in terms of a provision of the NEMA Financial Regulations must be regarded as having been undertaken in terms of the provision of these Regulations (Reg 17(1)). A financial provision approved in terms of the MPRDA Regulations, 2004 must also be regarded to be the financial provision approved in terms of the NEMA Financial Regulations (Reg 17(4)).

**One of the conditions in terms of Regulation 17 (4) is that a holder that operates in terms of a financial provision approved in terms of the Mineral and Petroleum Resources Development Act, 2002 at the time of the coming into operation of the NEMA Financial Regulations, must review and align such approved financial provision with the provisions of the NEMA Financial Regulations on an annual basis as set out in regulations 9 and 11, read with the necessary changes.**

**This review fulfils the requirements of both the Final Rehabilitation, Decommissioning and Mine Closure Plan and the Environmental Risk Assessment Report required in terms of the NEMA (Act 107 of 1998) regulations and applicable MPRDA (Act No. 28 of 2002) regulations as indicated in the table below.**

<b>MPRDA Regulations 2004</b>	<b>NEMA EIA Regulations 2014</b>	<b>NEMA Financial Regulations 2015</b>
Closure plan	Closure plan	Final rehab., decommissioning and mine closure plan
Must forms part of the EMP Reg. 62	May be combined with the EMP Reg. 19	Must forms part of the EMP Reg. 11(2)
Environmental risk report Reg. 60 & Sect 43(4)	Provided for as part of Closure Plan Reg. 19(5) and 19(6)	Environmental risk assessment Must forms part of the EMP Reg. 10(3)

Several pieces of legislation are applicable to mine closure. Importantly, public participation is an integral part of mine closure and the process followed needs to fulfil the requirements of all relevant legislation. The following government departments have been identified amongst others as playing a key role in the closure process:

- Department of Minerals Resources (DMR). Lead agent, facilitator of closure inspections and issues the closure certificate,
- Department of Water and Sanitation (DWAS). Lead agent for potential water related issues and signs off on the mine closure certificate. Cancellation of Water Use license.
- Provincial Department of Environment and Nature Conservation (DENC). Gives input into the closure plan and guides and monitors protection of the natural environment.
- The local municipality and district municipality. Gives input into the mine closure plan and interfacing thereof with their integrated development plan (IDP) of the local area.

### **3 ENVIRONMENTAL AUTHORISATION (EMP) REQUIREMENTS**

The key closure objective described in the plans submitted as part of the EMP is to ensure that the affected environment is maintained in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof. The aesthetic value of the area will also be reinstated.

The main closure objective is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required. This key closure objective is now divided in three closure objectives as stated below with their supported suite of key mitigating activities. The closure objectives and mitigating activities stated below are still in agreement with those in the original plan with the latter having the added objective of a safe and healthy post-mining environment.

The objectives to meet the set goals as applied to the final decommissioning and mine closure discussed in section 3 below can be summarised as follow:

- Objective 1 - To create a safe and healthy post-mining environment
  - Safe excavations
    - Slope stability of remaining excavation
    - No potentially dangerous areas secured if required
  - Limited residual environmental impact
    - Develop a landscape that reduces the requirement for long term monitoring and management
    - No surface and/or groundwater contamination
    - Waste management practices not creating or leaving legacies
- Objective 2 - To create a stable, free draining post mining landform, which is compatible with the surrounding landscape
  - Economically viable and sustainable land, as close as possible to its natural state.
    - Prepare area to promote natural re-establishment of vegetation that is self-sustaining, perpetual and provides a sustainable habitat for local fauna and successive flora species
    - Prevent long term changes in land use by implementing prompt rehabilitation and maintenance of disturbances when possible as part of annual rehabilitation plan.
  - Stable, free draining post mining landform
    - Prevent alteration or diverting natural drainage lines and reduced natural runoff.
    - Prevent concentration of runoff, mixing of clean runoff with contaminated runoff and creation of large open water bodies.
- Objective 3 – To provide optimal post-mining social opportunities
  - Optimised benefits for the social environment
    - Positive and transparent relationships with stakeholders and maintaining communication channels, providing stakeholders including government authorities with relevant information as per legislative requirements.
    - Undertaking environmental management according to approved EMP and Closure plans and regular auditing of the environmental management system.
  - Minimal negative aesthetic impact
    - Mitigate the nuisance effects of air emissions (dust), visual intrusion and the cumulative effect of a raise in the ambient noise levels
    - Prevent disturbance of archaeological sites and implement mitigating measures according to the archeological assessment.

#### **4 FINAL DECOMMISSIONING AND CLOSURE OF MINING OPERATION**

From the point of view of the environmental impact created, dimension stone mining is a relatively benign industry. There are no emissions besides those of the diesel powered earthmoving equipment utilised in its extraction and a small amount of blasting gases. Contamination of water resources is only likely in the event of petrochemical spillages from storage facilities and equipment, and these can largely be either prevented or cleaned up effectively.

Similarly, mining methods themselves generally have a low impact on the surrounding environment due to the need to carefully extract large blocks or slabs without damage to the stone. Recent advances in dimension stone mining technology have also had the effect of reducing environmental impacts. Particularly in granites, improvement in diamond wire sawing and rotary saw efficiency has significantly reduced the use of explosives in the extraction of blocks. This has resulted in higher recovery of saleable blocks and therefore less waste to be disposed of, as well as reducing the emissions of blasting gases (SO<sub>2</sub> and NO<sub>x</sub>), noise and ground vibration.

According to Ashmole and Motloun (2008) the major environmental impacts are of a visual nature, while in sensitive areas, habitat destruction and the destruction of archaeological heritage may become significant impacts but as the environmental impacts is often highly visible in comparison with the environmental impacts of other industries the attitude of the general public is based on the erroneous assumption that adverse visual impact is the same as severe environmental impact. In this regard, the study in Australia suggesting that mining was responsible for 1.1% of presumed extinctions of endangered plant species, compared with 38.2% attributed to grazing and 49.4% to agriculture could also be true for the semi-arid regions of South Africa although the public perception sees mining as a far greater threat to biodiversity than agricultural uses of the land.

Ashmole and Motloun (2008) also state that due to the attitude of the general public with regards to the dimension stone industry, granite and slate mines have been classified as medium risk operations, the same risk category as large gold, silver and uranium mines, and a higher risk than anything other than coal, metal sulphide, asbestos and antimony mines. However, all other dimension stone sources are classified as low risk operations.

The environmental impacts of dimension stone are generally not significant, are mainly of temporary duration, and can be effectively managed. While there is an economic cost to limiting environmental impacts, these costs are not significant in dimension stone mining if proper planning and consideration is applied from the exploration stage through to mine closure. In fact, it has been noted that truly environmentally conscious operation requires that activities be conducted with the future in mind, and that this will not only minimize the environmental effects of each activity, but will also result in significant cost savings. In the context of the dimension stone industry, these cost savings are not limited to costs of restoration, but may also be real cost savings in operating costs when proper planning over the lifecycle of a deposit is applied.

Concurrent or progressive rehabilitation of disturbed areas is good practice and should be undertaken as this offers a number of advantages such as limiting the mine's environmental liability and limiting costs at closure as rehabilitation is included in the operational activities of the mine.

Rehabilitation measures to be implemented include improving the visual appearance of the disturbed areas, establishing a cover to provide erosion control, improving runoff water quality by minimising silt loads and controlling dust.

Concurrent rehabilitation and remediation are provided for in the annual rehabilitation plan and contain information that defines activities on an annual basis and how these relate to the Final closure vision, as detailed in this final rehabilitation, decommissioning and mine closure plan.

Annual reviews in terms of regulations 6(a) and 11(1)(a) of the NEMA Financial Regulations, that form part of the Annual Environmental Audit, assesses what closure objectives and criteria are being achieved through the implementation of the plan.

While some disturbed areas can be rehabilitated on a progressive basis during operation, others cannot be rehabilitated until mining is complete. For this reason, some rehabilitation is generally still required during and after closure. Remedial initiatives to minimize environmental impact during and after mining can be divided into three main categories:

- Firstly, the removal of surface infrastructure that cannot be used for other purposes.
- Secondly, the remediation and rehabilitation of old pits to remove the hazard they present to people and animals. Earthworks and contouring the mine area to as close as possible to the pre-mining landscape. This includes filling pits, trenches and small excavations; making pit side's safe and covering the surface area with subsoil and topsoil as necessary; and mitigation or restoration of all surface disturbances and revegetation of the pit slopes and waste rock dumps.
- Lastly, the removal and isolation of potential pollutants from the environment. Containment and treatment of contaminated water and correct storage and removal of hazardous materials. Waste rock present specific problems, as they are unsuitable for other uses. For this reason all waste rock and even low grade product produced are destined to remain in the environment.

The aims of rehabilitation should therefore look at limiting the long-term liabilities that will be borne by future generations. The aim of most engineered structures is to “withstand the ravages of nature”. Lessons learned from old mining activities will be used to plan rehabilitation in such a way that natural processes such as erosion do not result in significant pollution.

Where possible, natural systems will be used to control water pollution and vegetation cover should limit windblown dust pollution. Gradients will be reduced to levels where erosion is minimal, and natural revegetation is possible.

Areas that are not covered during concurrent rehabilitation as described in the Annual rehabilitation plan that require specific intervention as part of this final rehabilitation, decommissioning and mine closure plan are discussed below. As the scale of operations is different for each of the quarries the rehabilitation and decommissioning required for each of the quarries is addressed separately. In order to make a value judgement regarding activities that must be controlled during mining, the operation were assessed relative to best practice principles.

## **4.1 Ivory and Desert Flame Quarries**

### **4.1.1 Infrastructure and Logistics area**

#### **a) Basic rehabilitation methodology**

Only when and if a market can be established for the material from these two quarries will the rehabilitation methodology be identified depending on completion of the planning phase that needs to be completed in consultation with the landowner.

The risk sources in the context of the receiving environment within the infrastructure and logistical area are addressed below with quantification that form part of the section 8.3 'Quantified Closure elements'.

#### **b) Risk sources**

Although both these operations if developed will continue from existing historic workings it can still be regarded as Greenfield operations and development must include the planning and implementation phases with regard to development of infrastructure and logistics in consultation with the landowner. This will include services like waste management, water reticulation and electrical power and the final layout together with risks will be addressed as part of the next review of this final rehabilitation, decommissioning and closure plan if planning for development has been completed.

### **4.1.2 Quarry and waste dumps**

#### **a) Basic rehabilitation methodology**

Prospecting work will only start during the next review period from 2017 and will only include non-invasive work that are in line with the prospecting work program. No prospecting work is planned during the next review period on the two historic quarries "Ivory" and "Desert Flame" as information is available from the historic workings.

At this stage the company will not be liable for any environmental degradation or visual impact caused by the historic workings but the basic rehabilitation methodology when and if bulk sampling operation started will however strive to replicate the pre-mining topography, wherever possible, or at least not to increase overall slope gradients without emplacement of adequately designed erosion control or runoff diversion structures.

The risk sources in the context of the receiving environment are addressed below with quantification that form part of the section 8.3 'Quantified Closure elements'.

#### **b) Risk sources**

Although both these operations if developed will continue from existing historic workings it can still be regarded as greenfield operations and development must include the planning and implementation phases with regard to development of mine or pit footprint, access ramps and haul roads, waste dumps and product stockpiles, handling areas, water reticulation and electrical power in consultation with the landowner.

Mine layout and risks will be addressed as part of the next review of this final rehabilitation, decommissioning and closure plan if planning for development has been completed.

## **4.2 Rainbow**

### **4.2.1 Infrastructure and Logistics area**

#### **a) Basic rehabilitation methodology**

At the quarry only satellite logistics will be supplied together with waste management facilities. The main post closure objective for the infrastructure area is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required. The aim is to ensure that the affected environment is maintained in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof. The aesthetic value of the area will also be reinstated.

The general approach adopted is the complete removal of all infrastructure and equipment and to reuse all infrastructures and equipment at another location by the company. Redundant structures, buildings and civil foundations (down to one meter below surface for subsurface infrastructure) will be removed for use elsewhere or demolished and discarded. All steel structures and reinforcing will be discarded or sold as scrap. Building rubble will be buried together with any remaining waste blocks. The compacted salvage yard, lay down and movement areas will be screened for petrochemical spills and cleaned before it is ripped and leveled. All redundant water pipes, pumps, power lines and cable associated with raw water and electrical supply will be removed. Service roads needs to be maintained and handed over to the landowner in a good state of repair and all redundant fences needs to be removed. All temporary waste storage areas needs to be cleaned out and waste removed. Waste material of any description, including receptacles, scrap, rubble and tyres, will be removed entirely from the complete mining area and disposed of at a recognised landfill facility. It will not be buried or burned on the site. The risk sources in the context of the receiving environment within the infrastructure and logistical area are provided below and shown in diagram 8 with quantification that form part of the section 8.3 'Quantified Closure elements'.

#### **b) Risk sources**

- Access and Haul Roads
  - Access from the HQ to the mine workings is via a dual use public road system and existing farm tracks.
  - Existing tracks will be used as haul roads and will only be upgraded to facilitate haul trucks by applying dust suppression and/or hardening compound such as Macadamite.
  - The service roads will remain as part of farm improvement and the mine is only responsible for the maintenance of the road.
- Services and associated infrastructure
  - Process and potable water is obtained from boreholes on the property.
  - Storage consisting of a 5 000 liter plastic tank that can be re-used on another operation.
  - A collection sumps for the recycling of process water used to cool the rock saws.
  - Electrical supply for the rock saws and logistics are generated by mobile gensets supplied with generator bay and spill prevention measures.
  - Underground water reticulation laid-on to the mine work area to feed water to the logistics.
- Accommodation and Logistics
  - Planning and development of infrastructure and waste management facilities are still in progress.
  - No steel or reinforced concrete buildings and structures are present on the mining area that will require demolition.
  - All waste rock structures used as part of accommodation, site office and secure storage needs to be demolish and waste blocks buried together with any remaining cement floors or footings.



- Structures in the form of pre-fabricated buildings including the fuel tank that can be re-used on another location must be removed from site
- The cement structures for the fuel supply including service aprons needs to be demolished together with any remaining cement floors or footings.
- Waste management facilities
  - A small demarcated laydown area for equipment prior to movement to the company HQ.
  - A small salvage yard for temporary storage of scrap steel prior to movement to the company HQ.
  - Domestic waste are collected in plastic containers and transported weekly to the company HQ refuse site.
  - Petrochemical and hazardous waste including contaminated/used spares, filters and used oil are collected and stored in special containers with spill containment measures for disposal at a registered disposal site.
- Oil/grease/diesel management systems
  - The service and wash bay at the company HQ will be used.

#### 4.2.2 Quarry and waste dumps

##### a) Basic rehabilitation methodology

Granite mining operations commonly have a permanent impact on rock masses that influences the topography on the site and can impact post-mining slope stability.

As the ore body is traced deeper and deeper into the ground a series of benches for both access and safety needs to be used. Sometimes rock surrounding the ore has to be removed so that the sides of the pit do not become dangerously steep. The waste rock is dumped away from the pit onto a surface waste dump. The opportunities for land use following open-pit mining are limited, because it is very expensive to fill the pit and the impact on topography can only be partially mitigated during rehabilitation. Post mining topography for most of the area will follow the original landform shape except where changes due to quarrying or waste dumps has occurred.

The main objective is usually to make the pit walls safe and to landscape the waste rock dumps. Ore bodies like granite that lend themselves to open-pit mining are not prone to causing water pollution and therefore water accumulating in the rehabilitated pit can usually be used for a number of purposes. Due to semi-arid conditions the opencast pits will not intercept shallow groundwater table zones with resulting water-make in the pit that will require pumping and storage in order to reduce inundation of active areas.

The post closure objective according to the approved closure plan is to restore the land to its pre-mining carrying capacity for stock farming taking into account the altered landform on the mining area due to mining activities and the absence of natural vegetation on the granite domes. Re-vegetation of other disturbed areas will follow a process of natural plant succession starting with pioneer plants.

The main closure objective therefore is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required. The aim is to ensure that the affected environment is maintained in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof. The aesthetic value of the area will also be reinstated.

The basic rehabilitation methodology will therefore strive to replicate the pre-mining topography, wherever possible, or at least not to increase overall slope gradients without emplacement of adequately designed erosion control or runoff diversion structures.

The risk sources in the context of the receiving environment within the infrastructure and logistical area are provided below and shown in diagram 8 with quantification that form part of the section 8.3 'Quantified Closure elements'.

b) Risk sources

- Opencast workings (including final voids and ramps)
  - Deep unsafe excavations
  - High walls remaining
- Residue deposits overburden and spoils
  - The only spoils to be generated is the relative large volume of waste blocks.
  - The existing side hill fill waste dump will be used during new operations
- Surface disturbance (compacted areas)
  - The stockpile and dispatch area for first grade blocks at the company HQ will be used.
  - The sorting and dressing area together with stockpile area for low grade blocks to be demarcated and the footprint contained.
  - Regular sorting and dispatch of blocks to be done as part of housekeeping.
  - Blocks used for demarcation purposes to be removed to the demarcated waste dump at final closure.

**Diagram 8: Plan showing development and historic workings at the Rainbow Quarry on Portion 1 Lower Zwartmodder 79 NC-S 30/5/1/1/2/10455PR as well as access from company HQ**



### 4.3 Cape Autum

#### 4.3.1 Infrastructure and Logistics area

##### a) Basic rehabilitation methodology

At the quarry only satellite logistics will be supplied together with waste management facilities. The main post closure objective for the infrastructure area is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required. The aim is to ensure that the affected environment is maintained in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof. The aesthetic value of the area will also be reinstated.

The general approach adopted is the complete removal of all infrastructure and equipment and to reuse all infrastructures and equipment at another location by the company. Redundant structures, buildings and civil foundations (down to one meter below surface for subsurface infrastructure) will be removed for use elsewhere or demolished and discarded. All steel structures and reinforcing will be discarded or sold as scrap. Building rubble will be buried together with any remaining waste blocks. The compacted salvage yard, lay down and movement areas will be screened for petrochemical spills and cleaned before it is ripped and leveled. All redundant water pipes, pumps, power lines and cable associated with raw water and electrical supply will be removed. Service roads needs to be maintained and handed over to the landowner in a good state of repair and all redundant fences needs to be removed. All temporary waste storage areas needs to be cleaned out and waste removed. Waste material of any description, including receptacles, scrap, rubble and tyres, will be removed entirely from the complete mining area and disposed of at a recognised landfill facility. It will not be buried or burned on the site. The risk sources in the context of the receiving environment within the infrastructure and logistical area are provided below and shown in diagram 9 with quantification that form part of the section 8.3 'Quantified Closure elements'.

##### b) Risk sources

- Access and Haul Roads
  - Access from the HQ to the mine workings is via a dual use public road system and existing farm tracks.
  - Existing tracks will be used as haul roads and will only be upgraded to facilitate haul trucks by applying dust suppression and/or hardening compound such as Macadamite.
  - The service roads will remain as part of farm improvement and the mine is only responsible for the maintenance of the road.
- Services and associated infrastructure
  - Process and potable water is obtained from boreholes on the property.
  - Storage consisting of a 5 000 liter plastic tank that can be re-used on another operation.
  - A collection sumps for the recycling of process water used to cool the rock saws.
  - Electrical supply for the rock saws and logistics are generated by mobile gensets supplied with generator bay and spill prevention measures.
  - Underground water reticulation laid-on to the mine work area to feed water to the logistics.
- Accommodation and Logistics
  - Planning and development of infrastructure and waste management facilities are still in progress.
  - No steel or reinforced concrete buildings and structures are present on the mining area that will require demolition.
  - All waste rock structures used as part of accommodation, site office and secure storage needs to be demolish and waste blocks buried together with any remaining cement floors or footings.



- Structures in the form of pre-fabricated buildings including the fuel tank that can be re-used on another location must be removed from site
- The cement structures for the fuel supply including service aprons needs to be demolished together with any remaining cement floors or footings.
- Waste management facilities
  - A small demarcated laydown area for equipment prior to movement to the company HQ.
  - A small salvage yard for temporary storage of scrap steel prior to movement to the company HQ.
  - Domestic waste are collected in plastic containers and transported weekly to the company HQ refuse site.
  - Petrochemical and hazardous waste including contaminated/used spares, filters and used oil are collected and stored in special containers with spill containment measures for disposal at a registered disposal site.
- Oil/grease/diesel management systems
  - The service and wash bay at the company HQ will be used.

#### 4.3.2 Quarry and waste dumps

##### a) Basic rehabilitation methodology

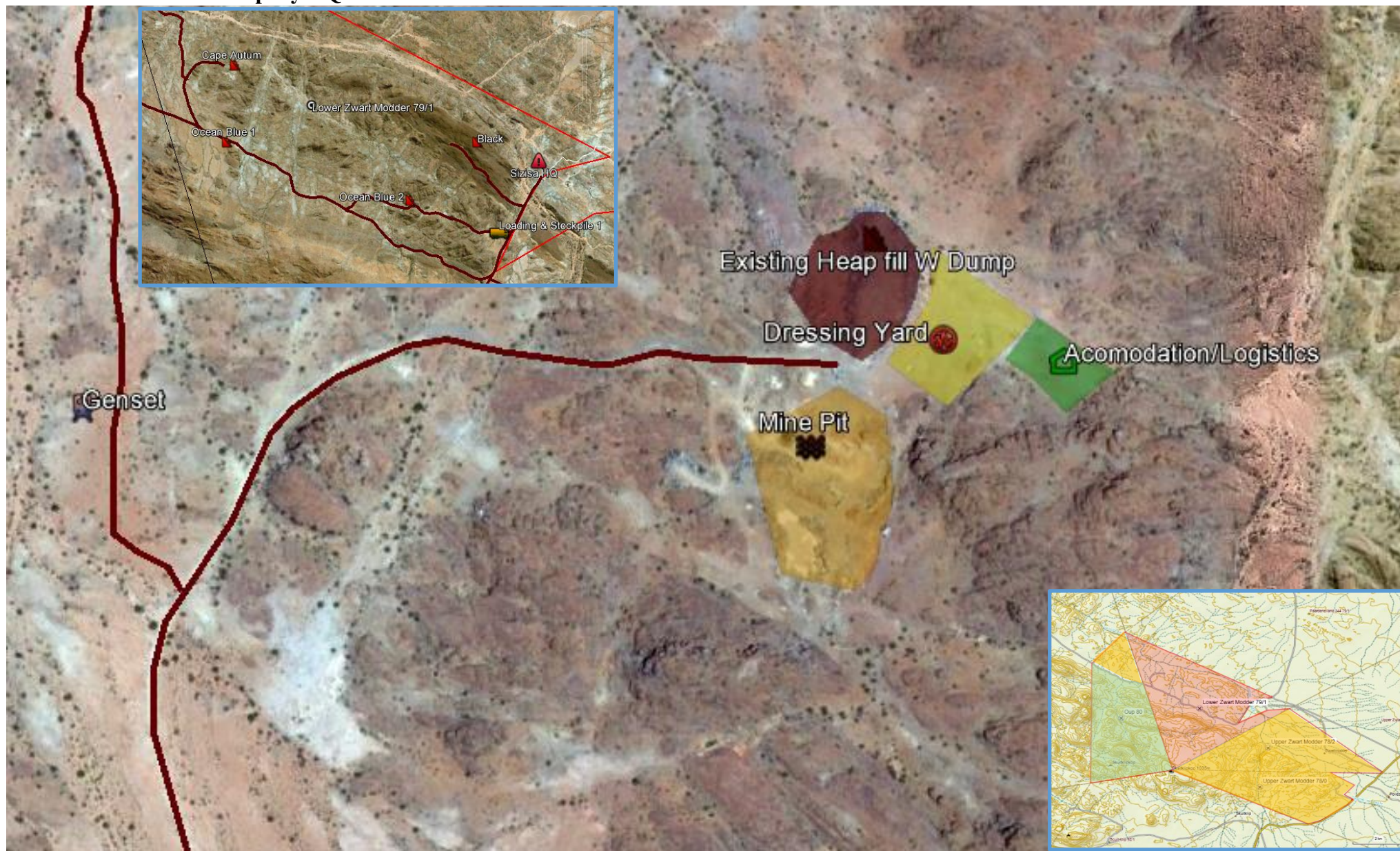
The basic rehabilitation methodology will be the same as for the Rainbow Quarry.

The risk sources in the context of the receiving environment are provided below and shown in diagram 9 with quantification that form part of the section 8.3 'Quantified Closure elements'.

##### b) Risk sources

- Opencast workings (including final voids and ramps)
  - Deep unsafe excavations
  - High walls remaining
- Residue deposits overburden and spoils
  - The only spoils to be generated is the relative large volume of waste blocks.
  - The existing heaped fill waste dump will be used during new operations
- Surface disturbance (compacted areas)
  - The stockpile and dispatch area for first grade blocks at the company HQ will be used.
  - The sorting and dressing area together with stockpile area for low grade blocks to be demarcated and the footprint contained.
  - Regular sorting and dispatch of blocks to be done as part of housekeeping.
  - Blocks used for demarcation purposes to be removed to the demarcated waste dump at final closure.

**Diagram 9: Plan showing development and historic workings at the Cape Autum Quarry on Portion 1 Lower Zwartmodder 79 NC-S 30/5/1/1/2/10455PR as well as access from company HQ**



#### **4.4 Ocean Blue 1 Quarry**

##### **4.4.1 Infrastructure and Logistics area**

###### **a) Basic rehabilitation methodology**

The basic rehabilitation methodology will be the same as for the Cape Autumn Quarry.

The risk sources in the context of the receiving environment are provided below and shown in diagram 10 with quantification that form part of the section 8.3 'Quantified Closure elements'.

###### **b) Risk sources**

This is still Greenfield operations and development must include the planning and implementation phases with regard to development of infrastructure and logistics. Due to its close proximity to the Cape Autumn quarry most of the infrastructure will be shared.

- Access and Haul Roads
  - Access from the HQ to the mine workings is via a dual use public road system and existing farm tracks.
  - Existing tracks will be used as haul roads and will only be upgraded to facilitate haul trucks by applying dust suppression and/or hardening compound such as Macadamite.
  - The service roads will remain as part of farm improvement and the mine is only responsible for the maintenance of the road.
- Services and associated infrastructure
  - Process and potable water is obtained from boreholes on the property.
  - Storage consisting of a 5 000 liter plastic tank that can be re-used on another operation.
  - A collection sumps for the recycling of process water used to cool the rock saws.
  - Electrical supply for the rock saws and logistics are generated by mobile gensets supplied with generator bay and spill prevention measures.
  - Underground water reticulation laid-on to the mine work area to feed water to the logistics.
- Accommodation and Logistics
  - This will be shared with the Cape Autumn Quarry
- Waste management facilities
  - This will be shared with the Cape Autumn Quarry
- Oil/grease/diesel management systems
  - This will be shared with the Cape Autumn Quarry

##### **4.4.2 Quarry and waste dumps**

###### **a) Basic rehabilitation methodology**

The basic rehabilitation methodology will be the same as for the Cape Autumn Quarry.

The risk sources in the context of the receiving environment are provided below and shown in diagram 10 with quantification that form part of the section 8.3 'Quantified Closure elements'.

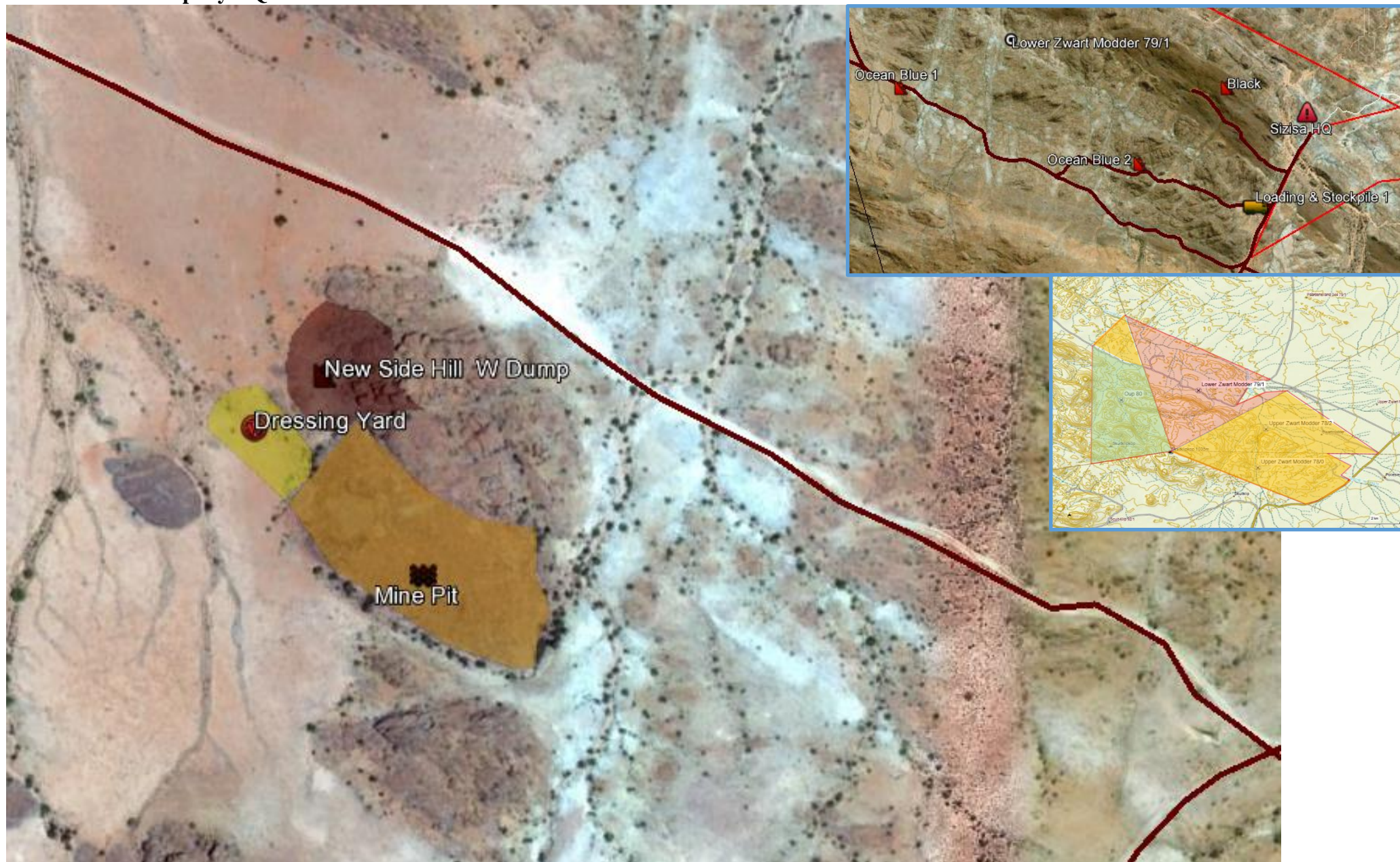
###### **c) Risk sources**

- Opencast workings (including final voids and ramps)
  - Deep unsafe excavations
  - High walls remaining
- Residue deposits overburden and spoils
  - The only spoils to be generated is the relative large volume of waste blocks.
  - The existing heaped fill waste dump at the Cape Autumn Quarry will be used during new operations or a new side hill fill waste dump will be developed
- Surface disturbance (compacted areas)

This will be shared with the Cape Autumn Quarry



**Diagram 10: Plan showing proposed development at the Ocean Blue 1 Quarry on Portion 1 Lower Zwartmodder 79 NC-S 30/5/1/1/2/10455PR as well as access from company HQ**





## **4.5 Ocean Blue 2 Quarry**

### **4.5.1 Infrastructure and Logistics area**

#### **a) Basic rehabilitation methodology**

The basic rehabilitation methodology will be the same as for the Cape Autumn quarry with the exception that no further work is planned at this quarry.

Rehabilitation of this area will be completed as part of the annual rehabilitation plan and at final decommissioning there will be no outstanding rehabilitation. The risk sources in the context of the receiving environment within the infrastructure and logistical area are provided below and shown in diagram 11 with quantification that form part of the section 8.3 'Quantified Closure elements'.

#### **b) Risk sources**

No infrastructure and logistics remains on this area that will require demolishing and or rehabilitation.

### **4.5.2 Quarry and waste dumps**

#### **a) Basic rehabilitation methodology**

The basic rehabilitation methodology will be the same as for the Cape Autumn Quarry.

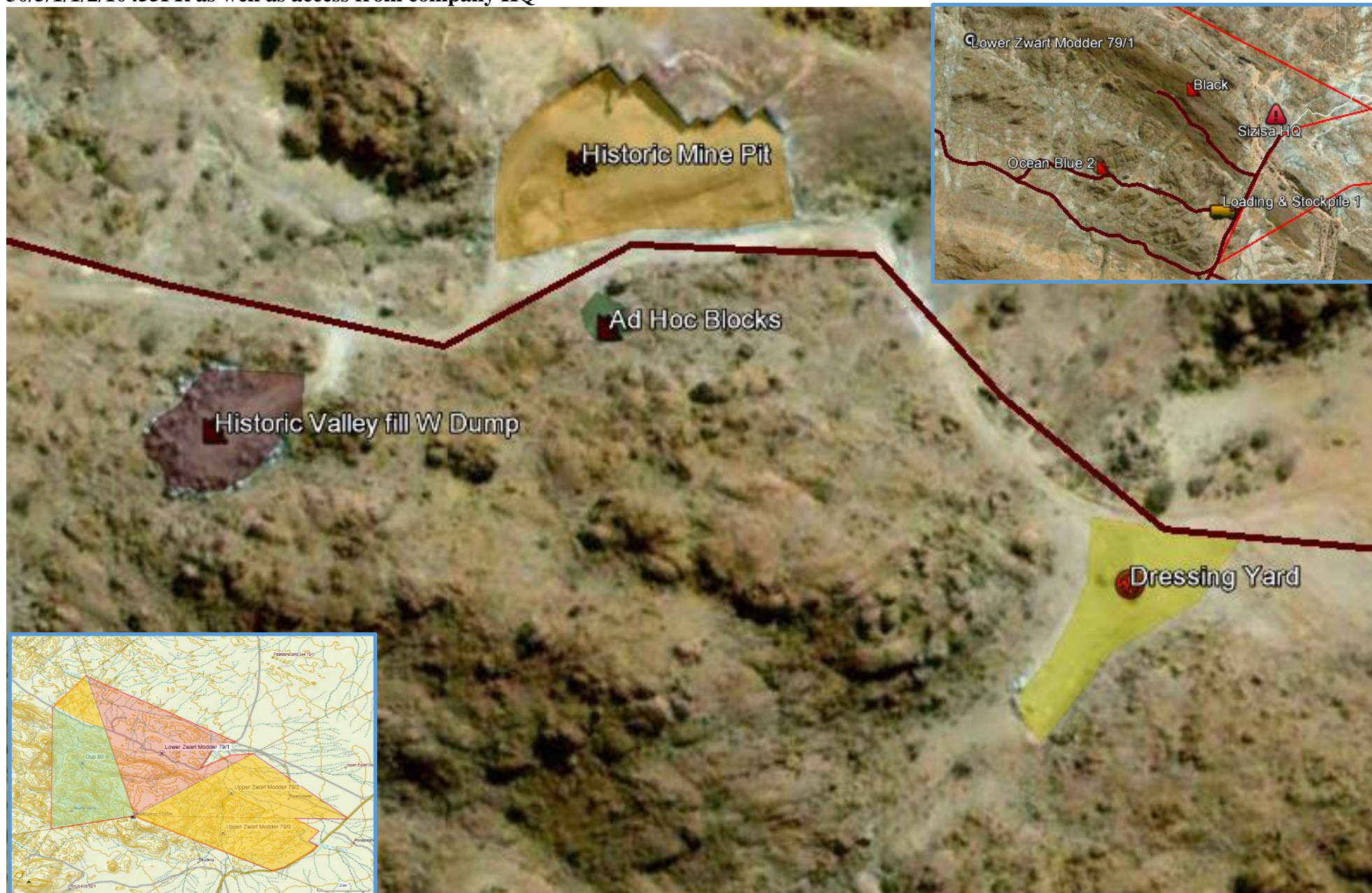
The basic rehabilitation methodology will therefore strive to replicate the pre-mining topography, wherever possible, or at least not to increase overall slope gradients without emplacement of adequately designed erosion control or runoff diversion structures.

The risk sources in the context of the receiving environment are provided below and shown in diagram 11 with quantification that form part of the section 8.3 'Quantified Closure elements'.

#### **b) Risk sources**

- Opencast workings
  - No deep or unsafe excavations are present
  - High walls remaining needs to be mitigated by stacking waste blocks against the face and shading of exposed rock faces with ferric chloride
- Residue deposits overburden and spoils
  - The existing valley fill waste dump will not require shaping but ferric chloride must be used to shade exposed blocks
- Surface disturbance (compacted areas)
  - The sorting and dressing area together with stockpile area for low grade blocks to be ripped and profiled with erosion control measures.
  - Blocks used for demarcation purposes or in the dressing yard to be removed to the demarcated waste dump.

**Diagram 11: Plan showing historic workings at the Ocean Blue 2 Quarry to be rehabilitated on Portion 1 Lower Zwartmodder 79 NC-S 30/5/1/1/2/10455PR as well as access from company HQ**



## **4.6 Black**

### **4.6.1 Infrastructure and Logistics area**

#### **a) Basic rehabilitation methodology**

No infrastructure will be developed as part of this bulk sampling operation and operations will be run from the company HQ.

The main post closure objective for the infrastructure area is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required. The aim is to ensure that the affected environment is maintained in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof. The aesthetic value of the area will also be reinstated. The risk sources in the context of the receiving environment within the infrastructure and logistical area are provided below and shown in diagram 12 with quantification that form part of the section 8.3 'Quantified Closure elements'.

#### **b) Risk sources**

- Access and Haul Roads
  - Access from the HQ to the mine workings is via a dual use public road system and existing farm tracks.
  - Existing tracks will be used as haul roads and will only be upgraded to facilitate haul trucks by applying dust suppression and/or hardening compound such as Macadamite.
  - The service roads will remain as part of farm improvement and the mine is only responsible for the maintenance of the road.
- Services and associated infrastructure
  - Process and potable water is obtained from boreholes on the property.
  - Storage consisting of a 5 000 liter plastic tank that can be re-used on another operation.
  - Underground water reticulation laid-on to the mine work area to feed water to the logistics.
  - A collection sumps for the recycling of process water used to cool the rock saws.
  - Electrical supply for the rock saws and logistics are generated by mobile gensets supplied with generator bay and spill prevention measures.
- Accommodation and Logistics
  - The facilities at the company HQ will be used
- Waste management facilities
  - Due to the close proximity of the company HQ the waste management facilities available at the HQ will be used.
- Oil/grease/diesel management systems
  - The service and wash bay at the company HQ will be used.

### **4.6.2 Quarry and waste dumps**

#### **a) Basic rehabilitation methodology**

The basic rehabilitation methodology will be the same as for the Cape Autumn Quarry.

The risk sources in the context of the receiving environment are provided below and shown in diagram 12 with quantification that form part of the section 8.3 'Quantified Closure elements'.

#### **b) Risk sources**

- Opencast workings (including final voids and ramps)
  - Deep unsafe excavations
  - High walls remaining
- Residue deposits overburden and spoils
  - The only spoils to be generated is the relative large volume of waste blocks.
  - The existing valley fill waste dump will not be used during new operations and a new valley fill dump needs to be created

- Surface disturbance (compacted areas)
  - The stockpile and dispatch area for first grade blocks at the company HQ will be used.
  - The sorting and dressing area together with stockpile area for low grade blocks to be demarcated and the footprint contained.
  - Regular sorting and dispatch of blocks to be done as part of housekeeping.
  - Blocks used for demarcation purposes to be removed to the demarcated waste dump at final closure.



**Diagram 12: Plan showing development and historic workings at the Black Quarry on Portion 1 Lower Zwartmodder 79 NC-S 30/5/1/1/2/10455PR as well as access from company HQ**



## **4.7 Red 1 Quarry**

### **4.7.1 Infrastructure and Logistics area**

#### **a) Basic rehabilitation methodology**

The main post closure objective for the infrastructure area is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required. The aim is to ensure that the affected environment is maintained in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof. The aesthetic value of the area will also be reinstated.

The general approach adopted is the complete removal of all infrastructure and equipment and to reuse all infrastructures and equipment at another location by the company. Redundant structures, buildings and civil foundations (down to one meter below surface for subsurface infrastructure) will be removed for use elsewhere or demolished and discarded. All steel structures and reinforcing will be discarded or sold as scrap. Building rubble will be buried together with any remaining waste blocks. The compacted salvage yard, lay down and movement areas will be screened for petrochemical spills and cleaned before it is ripped and leveled. All redundant water pipes, pumps, power lines and cable associated with raw water and electrical supply will be removed. Service roads needs to be maintained and handed over to the landowner in a good state of repair and all redundant fences needs to be removed. All temporary waste storage areas needs to be cleaned out and waste removed. Waste material of any description, including receptacles, scrap, rubble and tyres, will be removed entirely from the complete mining area and disposed of at a recognised landfill facility. It will not be buried or burned on the site. The risk sources in the context of the receiving environment within the infrastructure and logistical area are provided below and shown in diagram 15 with quantification that form part of the section 8.3 'Quantified Closure elements'.

#### **b) Risk sources**

- Access and Haul Roads
  - Access from the HQ to the mine workings is via a dual use public road system and existing farm tracks.
  - Existing tracks will be used as haul roads and will only be upgraded to facilitate haul trucks by applying dust suppression and/or hardening compound such as Macadamite.
  - The service roads will remain as part of farm improvement and the mine is only responsible for the maintenance of the road.
- Services and associated infrastructure
  - Process and potable water is obtained from boreholes on the property.
  - Storage consisting of a 10 000 liter plastic tank that can be re-used on another operation.
  - A collection sumps for the recycling of process water used to cool the rock saws.
  - Electrical supply to the logistics area is obtained from an Eskom supply.
  - Electrical supply for the rock saws are generated by mobile gensets supplied with generator bay and spill prevention measures.
- Accommodation and Logistics
  - At the quarry only satellite logistics are supplied and infrastructure, buildings and waste management facilities consist of pre-fabricated buildings, mobile containers and/or structures created from waste blocks.
  - Upgrading of infrastructure and waste management facilities are still in progress.
  - No steel or reinforced concrete buildings and structures are present on the mining area that will require demolition.
  - All waste rock structures used as part of accommodation, site office and secure storage needs to be demolish and waste blocks moved to the waste dump together with any remaining cement floors or footings.

- Structures in the form of pre-fabricated buildings including the fuel tank that can be re-used on another location must be removed from site
- The cement structures for the fuel supply including service aprons needs to be demolished together with any remaining cement floors or footings.
- Waste management facilities
  - As part of waste management facilities a salvage yard, laydown area with parking and temporary waste storage facilities will be provided.
  - The workshop area needs to be upgraded with a temporary waste storage area, bio cell and laydown area
  - Domestic waste are collected in plastic containers and transported weekly to the company HQ.
  - Petrochemical and hazardous waste including contaminated/used spares, filters and used oil are collected and stored in special containers with spill containment measures for disposal at a registered disposal site.
- Oil/grease/diesel management
  - The service and wash bay at the company HQ will be used.
  - The fuel supply tank is provided at the company HQ and fuel is trucked onto the site for the generators and equipment.
  - The fuel truck must be provided with a parking area with spill containment measures.
  - The generators must be supplied with generator bays with spill containment measures.
- Surface disturbance
  - The centralised stockpile and dispatch area for first grade blocks at the HQ are shared with the other operations on the property and needs to be demarcated and the footprint contained.
  - The sorting and dressing area together with stockpile area for low grade blocks are developed on the historic valley filled waste dump.
  - Regular sorting and dispatch of blocks to be done as part of housekeeping.
  - The secondary waste rock dump needs to be shaped and covered with soil as part of annual rehabilitation to be used as a salvage yard
  - Blocks used for demarcation purposes to be removed to the demarcated waste dump.

#### 4.7.2 Quarry and waste dumps

##### a) Basic rehabilitation methodology

Granite mining operations commonly have a permanent impact on rock masses that influences the topography on the site and can impact post-mining slope stability.

As the ore body is traced deeper and deeper into the ground a series of benches for both access and safety needs to be used. Sometimes rock surrounding the ore has to be removed so that the sides of the pit do not become dangerously steep.

The waste rock is dumped away from the pit onto a valley fill waste dump. The opportunities for land use following open-pit mining are limited, because it is very expensive to fill the pit. The main objective is usually to make the pit high walls safe and to landscape the waste rock dumps.

The influence on topography can only be partially mitigated during rehabilitation. Due to semi-arid conditions the opencast pits will not intercept shallow groundwater table zones with resulting water-make in the pit that will require pumping and storage in order to reduce inundation of active areas.

The post closure objective according to the approved closure plan is to restore the land to its pre-mining carrying capacity for stock farming taking into account the altered landform on the mining area due to mining activities and the absence of natural vegetation on the granite domes. Re-vegetation of other disturbed areas will follow a process of natural plant succession starting

with pioneer plants Post mining topography for most of the area will follow the original landform shape except where changes due to quarrying or waste dumps have occurred.

The main closure objective therefore is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required. The aim is to ensure that the affected environment is maintained in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof. The aesthetic value of the area will also be reinstated.

The basic rehabilitation methodology will therefore strive to replicate the pre-mining topography, wherever possible, or at least not to increase overall slope gradients without emplacement of adequately designed erosion control or runoff diversion structures.

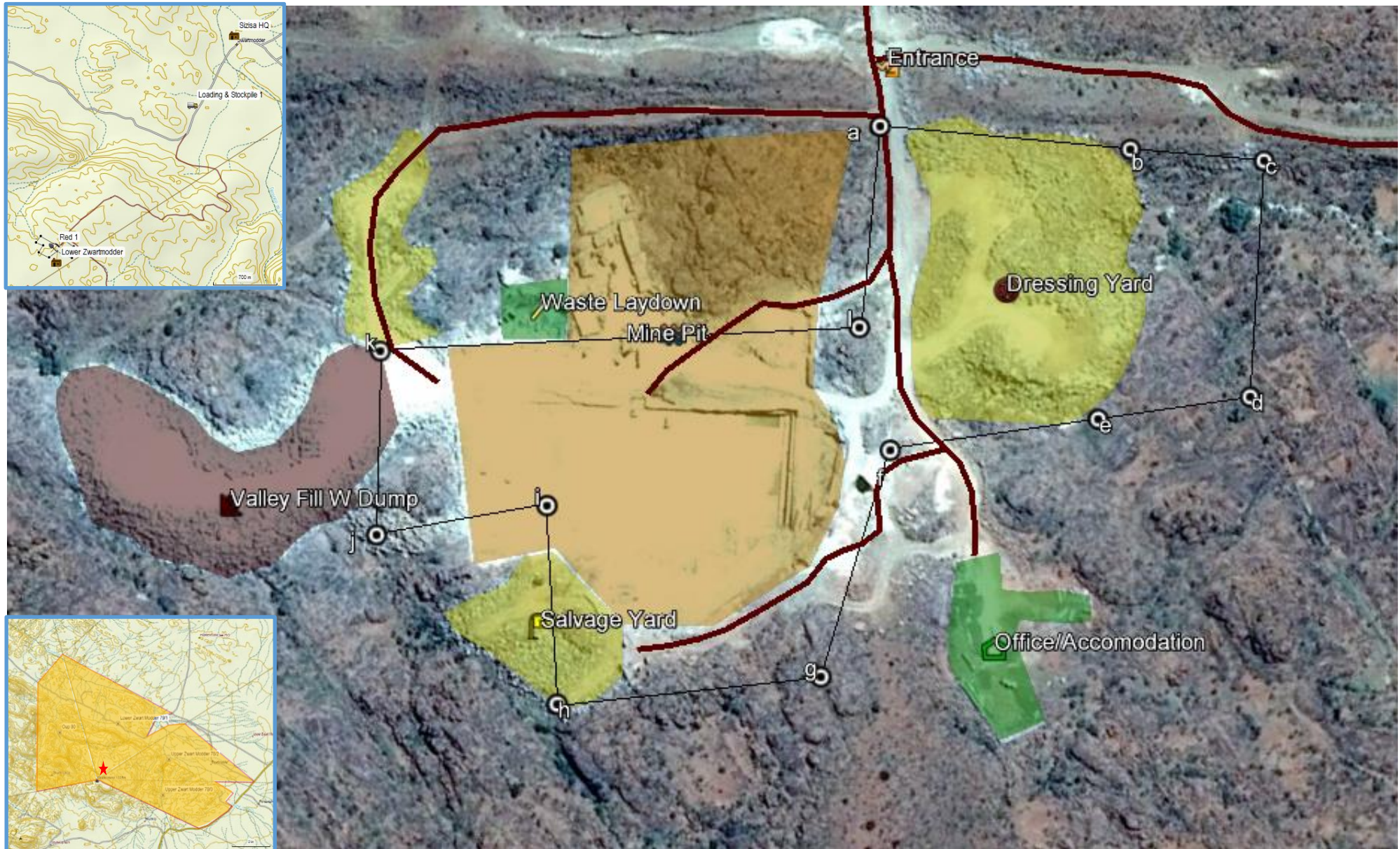
The risk sources in the context of the receiving environment within the infrastructure and logistical area are provided below and shown in diagram 12 with quantification that forms part of the section 8.3 'Quantified Closure elements'.

b) Risk sources

- Opencast workings (including final voids and ramps)
  - Deep unsafe excavations
  - High walls remaining
- Surface disturbance (compacted areas)
  - Sorting and stockpile areas
- Residue deposits overburden and spoils
  - The only spoils to be generated is the relative large volume of waste blocks
  - Only one waste dump needs to be created and the creation of secondary waste dumps must be prevented by regularly moving waste block to the designated areas.
  - Secondary waste dumps need to be shaped and rehabilitated as part of the annual rehabilitation plan.



**Diagram 13: Mine development plan NC 10358 MP - Red 1 - Portion 1 Lower Zwartmodder 79**



## 4.8 Red 2 and Red 3

### 4.8.1 Infrastructure and Logistics area

#### a) Basic rehabilitation methodology

The basic rehabilitation methodology will be the same as for the Red 1 Quarry.

The main post closure objective for the infrastructure area is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required. The aim is to ensure that the affected environment is maintained in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof. The aesthetic value of the area will also be reinstated. The risk sources in the context of the receiving environment within the infrastructure and logistical area are provided below and shown in diagram 14 and 15 with quantification that form part of the section 8.3 'Quantified Closure elements'.

#### b) Risk sources

- Access and Haul Roads
  - Access from the HQ to the mine workings is via a dual use public road system and existing farm tracks.
  - Existing tracks will be used as haul roads and will only be upgraded to facilitate haul trucks by applying dust suppression and/or hardening compound such as Macadamite.
  - The service roads will remain as part of farm improvement and the mine is only responsible for the maintenance of the road.
- Services and associated infrastructure
  - Process and potable water is obtained from boreholes on the property.
  - Storage consisting of a 5 000 liter plastic tank that can be re-used on another operation.
  - Underground water reticulation laid-on to the mine work area to feed water to the logistics.
  - A collection sumps for the recycling of process water used to cool the rock saws.
  - Electrical supply for the rock saws and logistics are generated by mobile gensets supplied with generator bay and spill prevention measures.
- Accommodation and Logistics
  - Accommodation and logistics will be shared between the Red 2 and Red 3 quarries and some of the logistics will be available at the Company HQ.
  - Planning and development of infrastructure and waste management facilities are still in progress.
  - At this quarries only satellite logistics are supplied and infrastructure, buildings and waste management facilities will consist of pre-fabricated buildings, mobile containers and/or structures created from waste blocks.
  - No steel or reinforced concrete buildings and structures will be present on the mining area that will require demolition.
  - All waste rock structures used as part of accommodation, site office and secure storage needs to be demolish and waste blocks removed to the rock waste dump together with any remaining cement floors or footings.
  - Structures in the form of pre-fabricated buildings including the fuel tank that can be re-used on another location must be removed from site
  - The cement structures for the fuel supply including service aprons needs to be demolished together with any remaining cement floors or footings.
- Waste management facilities
  - As part of waste management facilities a combined salvage yard, laydown area with parking and temporary waste storage facilities will be provided.
  - Domestic waste are collected in plastic containers and transported weekly to the company HQ.

- Petrochemical and hazardous waste including contaminated/used spares, filters and used oil are collected and stored in special containers with spill containment measures for disposal at a registered disposal site.
- Oil/grease/diesel management
  - The service and wash bay at the company HQ will be used.
  - The fuel supply tank is provided at the company HQ and fuel is trucked onto the site for the generators and earth moving equipment.
  - The fuel truck must be provided with a parking area with spill containment measures.
  - The generators must be supplied with generator bays with spill containment measures.
- Surface disturbance
  - The centralised stockpile and dispatch area for first grade blocks at the HQ are shared with the other operations on the property and needs to be demarcated and the footprint contained.
  - The sorting and dressing area together with stockpile area for low grade blocks must be developed as part of the valley filled waste dump at each of the quarries.
  - Regular sorting and dispatch of blocks to be done as part of housekeeping.
  - Blocks used for demarcation purposes to be removed to the demarcated waste dump.

#### 4.8.2 Quarry and waste dumps

##### a) Basic rehabilitation methodology

The basic rehabilitation methodology will be the same as for the Red 1 Quarry.

The basic rehabilitation methodology will therefore strive to replicate the pre-mining topography, wherever possible, or at least not to increase overall slope gradients without emplacement of adequately designed erosion control or runoff diversion structures.

The risk sources in the context of the receiving environment are addressed below and shown in diagram 14 and 15 with quantification that form part of the section 8.3 'Quantified Closure elements'.

##### b) Risk sources

This is still greenfield operations and development must include the planning and implementation phases with regard to development of mine or pit footprint, access ramps and haul roads, waste, residue and product stockpiles, handling areas, water reticulation and electrical power. Risk sources will be the same as for other quarries and include:

- Opencast workings (including final voids and ramps)
  - Deep unsafe excavations
  - High walls remaining
- Surface disturbance (compacted areas)
  - Sorting and stockpile areas
- Residue deposits overburden and spoils
  - The only spoils to be generated is the relative large volume of waste blocks
  - Only one waste dump needs to be created and the creation of secondary waste dumps must be prevented by regularly moving waste block to the designated areas.

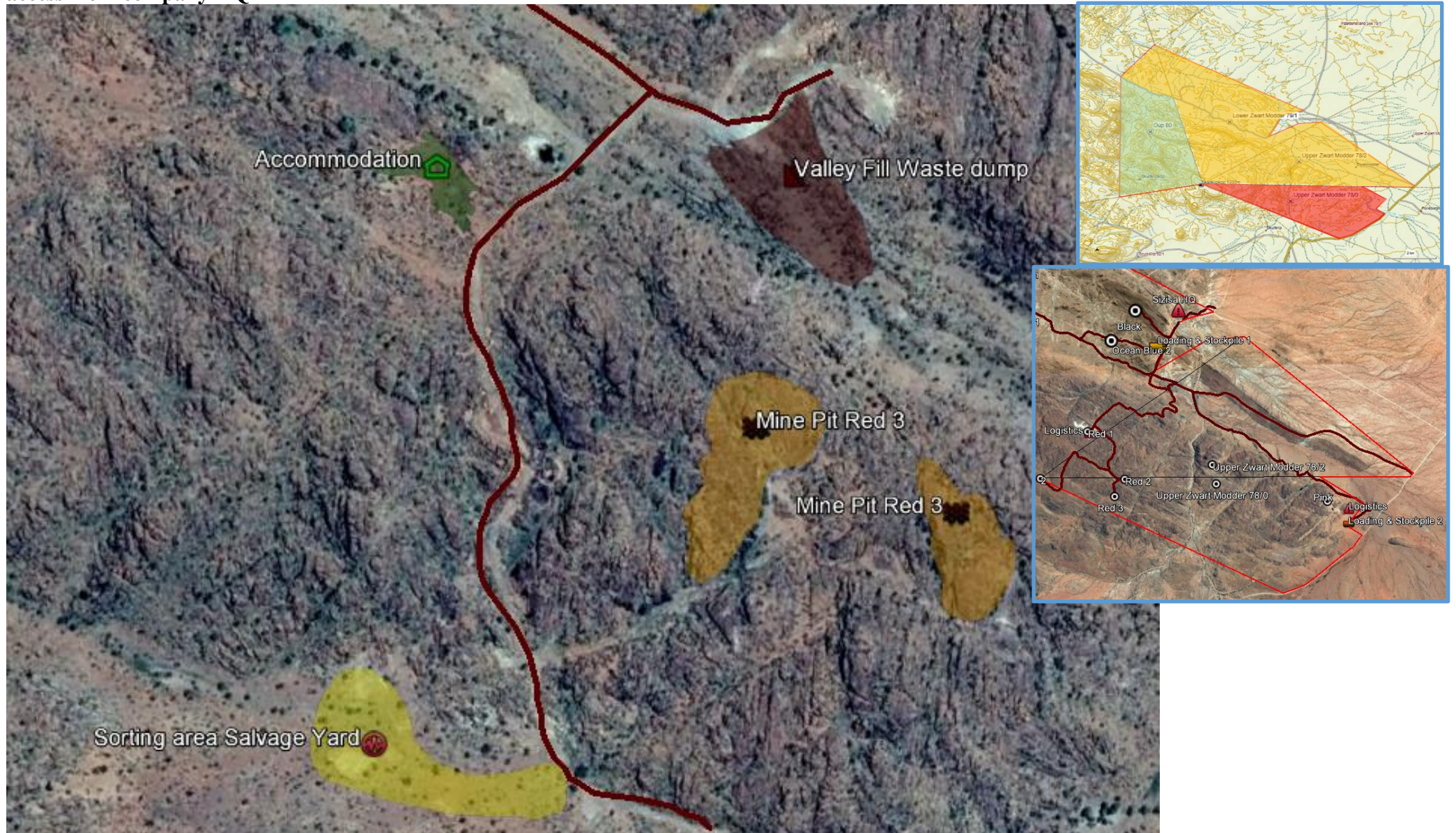


**Diagram 14: Plan showing proposed development at the Red 2 Quarry on the Remainder Upper Zwartmodder 78 NC-S 30/5/1/1/2/10610PR as well as access from company HQ**





**Diagram 15: Plan showing proposed development at the Red 3 Quarry on the Remainder Upper Zwartmodder 78 NC-S 30/5/1/1/2/10610PR as well as access from company HQ**



## 4.9 Pink Quarry

### 4.9.1 Infrastructure and Logistics area

#### a) Basic rehabilitation methodology

The main post closure objective for the infrastructure area is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required. The aim is to ensure that the affected environment is maintained in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof. The aesthetic value of the area will also be reinstated.

The general approach adopted is the complete removal of all infrastructure and equipment and to reuse all infrastructures and equipment at another location by the company. Redundant structures, buildings and civil foundations (down to one meter below surface for subsurface infrastructure) will be removed for use elsewhere or demolished and discarded. All steel structures and reinforcing will be discarded or sold as scrap. Building rubble will be buried together with any remaining waste blocks. The compacted salvage yard, lay down and movement areas will be screened for petrochemical spills and cleaned before it is ripped and leveled. All redundant water pipes, pumps, power lines and cable associated with raw water and electrical supply will be removed. Service roads needs to be maintained and handed over to the landowner in a good state of repair and all redundant fences needs to be removed. All temporary waste storage areas needs to be cleaned out and waste removed. Waste material of any description, including receptacles, scrap, rubble and tyres, will be removed entirely from the complete mining area and disposed of at a recognised landfill facility. It will not be buried or burned on the site. The risk sources in the context of the receiving environment within the infrastructure and logistical area are provided below and shown in diagram 16 with quantification that form part of the section 8.3 'Quantified Closure elements'.

#### b) Risk sources

- Access and Haul Roads
  - Access from the Logistics area to the mine workings is via a dual use public road system and existing farm tracks.
  - Existing tracks will be used as haul roads and will only be upgraded to facilitate haul trucks by applying dust suppression and/or hardening compound such as Macadamite.
  - The service roads will remain as part of farm improvement and the mine is only responsible for the maintenance of the road.
- Services and associated infrastructure
  - Process and potable water is obtained from boreholes on the property.
  - Storage consisting of a 5 000 liter plastic tank that can be re-used on another operation.
  - A collection sumps for the recycling of process water used to cool the rock saws.
  - Electrical supply to the logistics area is obtained from an Eskom supply.
  - Electrical supply for the rock saws are generated by mobile gensets supplied with generator bay and spill prevention measures.
- Accommodation and Logistics
  - At the quarry only satellite logistics are supplied and infrastructure, buildings and waste management facilities consist of pre-fabricated buildings and mobile containers.
  - Development of infrastructure and waste management facilities are still in progress.
  - No steel or reinforced concrete buildings and structures will be developed on the mining area that will require demolition.
  - All waste rock structures used as part of accommodation, site office and secure storage needs to be demolish and waste blocks buried together with any remaining cement floors or footings.



- Structures in the form of mobile units including the fuel tank that can be re-used on another location must be removed from site.
- Accommodation and some of the logistics will remain on site as part of farm improvement in terms of section 44 of the MPRDA.
- The cement structures for the fuel supply including service aprons needs to be demolished together with any remaining cement floors or footings.
- Waste management facilities
  - As part of waste management facilities a salvage yard and laydown with parking area and temporary waste storage area is provided.
  - Domestic waste are collected in plastic containers and transported weekly to the waste management facilities at the company HQ.
  - Petrochemical and hazardous waste including contaminated/used spares, filters and used oil are collected and stored in special containers with spill containment measures for disposal at a registered disposal site.
- Oil/grease/diesel management
  - A service and wash bay still needs to be developed and all grey water is collected in a sump together with process water used to cool the rock saws from where it is recycled
  - The fuel supply tank is provided with a bund wall and service apron.
  - All generators needs to be supplied with a generator bay and spill containment measures.
- Surface disturbance
  - The stockpile and dispatch area for first grade blocks needs to be demarcated and the footprint contained.
  - The sorting and dressing area together with stockpile area for low grade blocks will be developed on the historic valley filled waste dump to be used during new operations.
  - Regular sorting and dispatch of blocks to be done as part of housekeeping.
  - Blocks used for demarcation purposes to be removed to the demarcated waste dump.

#### 4.9.2 Quarry and waste dumps

##### c) Basic rehabilitation methodology

Granite mining operations commonly have a permanent impact on rock masses that influences the topography on the site and can impact post-mining slope stability.

As the ore body is traced deeper and deeper into the ground a series of benches for both access and safety needs to be used. Sometimes rock surrounding the ore has to be removed so that the sides of the pit do not become dangerously steep.

The waste rock is dumped away from the pit onto a valley fill waste dump. The opportunities for land use following open-pit mining are limited, because it is very expensive to fill the pit.

The main objective is usually to make the pit high walls safe and to landscape the waste rock dumps. The influence on topography can only be partially mitigated during rehabilitation. Due to semi-arid conditions the opencast pits will not intercept shallow groundwater table zones with resulting water-make in the pit that will require pumping and storage in order to reduce inundation of active areas.

The post closure objective according to the approved closure plan is to restore the land to its pre-mining carrying capacity for stock farming taking into account the altered landform on the mining area due to mining activities and the absence of natural vegetation on the granite domes. Re-vegetation of other disturbed areas will follow a process of natural plant succession starting with pioneer plants. Post mining topography for most of the area will follow the original landform shape except where changes due to quarrying or waste dumps has occurred.

The main closure objective therefore is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required.



The aim is to ensure that the affected environment is maintained in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof. The aesthetic value of the area will also be reinstated.

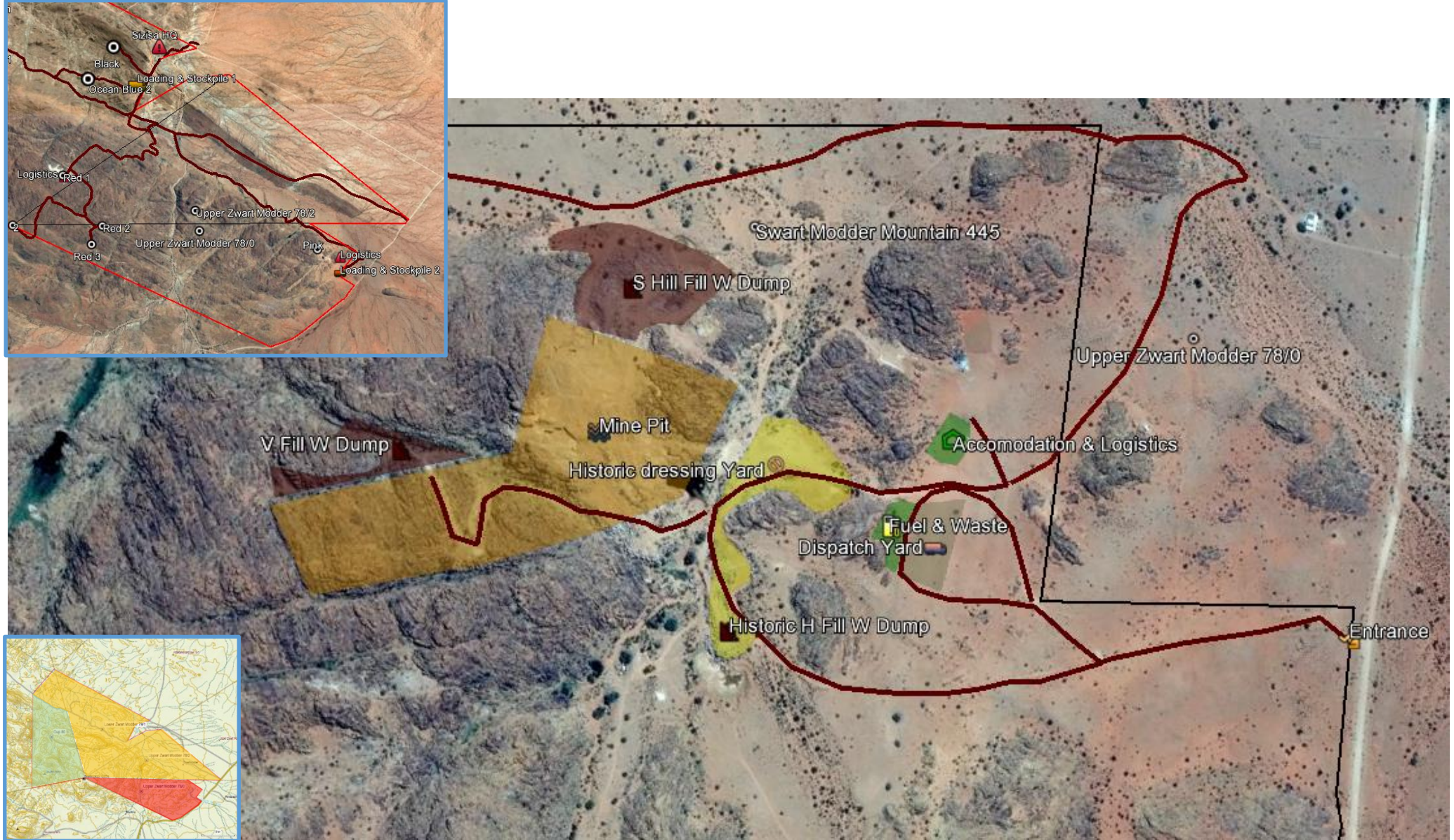
The basic rehabilitation methodology will therefore strive to replicate the pre-mining topography, wherever possible, or at least not to increase overall slope gradients without emplacement of adequately designed erosion control or runoff diversion structures.

The risk sources in the context of the receiving environment within the infrastructure and logistical area are provided below and shown in diagram 16 with quantification that form part of the section 8.3 'Quantified Closure elements'.

d) Risk sources

- Opencast workings (including final voids and ramps)
  - Deep unsafe excavations
  - High walls remaining
- Surface disturbance (compacted areas)
  - Sorting and stockpile areas
- Residue deposits overburden and spoils
  - The only spoils to be generated is the relative large volume of waste blocks
  - Only one waste dump needs to be identified and the creation of secondary waste dumps must be prevented by regularly moving waste block to the designated areas.
  - Waste used to create working platforms needs to be shaped and rehabilitated as with waste dumps.
  - Historic secondary waste dumps needs to be shaped and rehabilitated as part of the annual rehabilitation plan.

**Diagram 16: Plan showing proposed development at the Pink Quarry NC-S 30/5/1/1/2/10610PR as well as access from company HQ**



## **5 RISK IDENTIFICATION**

The potential risks arising from the above operation are generic for any granite mine and listed below. The impact rating of applicable risks and mitigation actions are addressed in the risk assessment section 7.

### **5.1 Potential Risks with regard to Safe excavations**

- Collapsing slope(s) of mine pit can be detrimental to the safety and health of humans and animals.
- Potentially dangerous areas like deep mine pit or equipment left behind and uncontrolled access to a potentially unsafe post-mining area
- Post mining topography not compatible with original landform.
- Unsafe erosion gulley's

### **5.2 Potential Risk of residual environmental impact**

- Post mining landscape that increase the requirement for long term monitoring and management.
- Unwanted ruins, buildings, foundations, footings and waste management practices creating or leaving legacies.
- Sub-surface infrastructure remaining behind, limiting the intended post closure land use including footings and foundations and power supply and water installations including pumps and pipelines.
- Equipment and other items used during the mining operation left behind.
- Incomplete removal of re-usable infrastructure.
- Rubble from demolished infrastructure left behind.
- Waste classes not kept in separate streams and incomplete removal of waste
- Large volumes of large blocks and bouldery rubble that requires large dumping areas.
- Creation of waste rock residue deposits or stockpiles with infiltration of leachate due to inadequate basal sealing or leakage from sealed pollution control facilities.
- Stockpiles and leftover product left behind
- Increased erosion, dust generation and potential chemical contaminants reduce surface water quality or result in discharge that exceeds the maximum concentrations permitted.
- Vehicle wash bays and workshop facilities produce petrochemical and solvent contaminated runoff.
- Sanitary conveniences, fuel depots or storage facilities of potentially polluting substances can contaminate surface water.
- Oil fuel leaks onto virgin soil through the earthmoving and transport equipment and machinery or spillage of fuel during transfer from fuel bowser to equipment in the field.
- Inadequate capping or sealing of the boreholes – can lead to infiltration of potentially contaminated surface water leading to chemical or biological contamination of groundwater.
- Drainage of benches and concentration of rainfall leads to creation of large volume open water bodies in worked out pit and can lead to increased groundwater recharge and potential regional impact of low quality water.
- Pumping of process water from the pit sump can discharge poor quality water exceeding minimum standards.

### **5.3 Potential Risks with regard to viable and sustainable land**

With granite mines complete disruption of the surface always occurs, which affects the soil, fauna, flora and surface water, thereby influencing all types of land use. Opencast mining and related infrastructure is a permanent destruction and rehabilitation cannot restore all pre-mining



habitats. Granite quarries cannot be completely refilled and form permanent depressions that must be accommodated through imaginative utilisation during the post-closure period and the residual impact of open-pit mining is usually a completely different land use. Risks associated with economically viable and sustainable land include:

- Uncontrolled expansion of mining footprint by not restricting the area disturbed by mining and the associated activities/infrastructure - loss of land with agricultural potential. Uncontrolled development of roads - existing farm roads not used for mining operations and redundant internal roads left behind. Dual used roads still needed by the landowner and fences not maintained or repaired.
- Post mining landform not compatible with the surrounding landscape and not capable of a productive land use that achieves a land capability equal to that of pre mining conditions
- Long term changes in land use caused by not implementing prompt rehabilitation and maintenance of disturbances when possible as part of annual rehabilitation plan.
- Unsuccessful rehabilitation can reduce the post-mining land use options. Rehabilitated areas could be too unstable to support post-mining land use objectives compatible with surrounding areas.
- Disturbance of agricultural potential and subdivision of high potential arable land into uneconomic farming units. Inadequate planning or loose development can subdivide high potential land or habitats into un-viable small areas.
- Disturbance of ecology due to loss of habitat and cumulative impact of illegal collecting or land use during long-term or life of mine can degrade areas and reduce the viability of adjacent areas. Inadequate control of alien species can result in establishment of populations or seed sources that threaten adjacent areas.

#### **5.4 Potential Risks with regard to stable, free draining post mining landform**

Opencast pit creates area of lowered topography that can act as a sump for storm water runoff and intersects groundwater and if the operation extends to depths below the water table, it will affect the near-surface groundwater. Apart from reducing natural recharge to the shallow and deep groundwater zones, the increased runoff and altered storm hydrograph will also impact areas downstream or downslope where the flow is concentrated.

- Impact on surface water through modification of infiltration rates by increasing the extent of hardened surfaces.
- Inadequate topsoil restoration or creation of un-natural surface topography or slope form which could impact lower or adjacent slopes due to increased runoff velocity.
- Altered storm water runoff response due to large impervious areas and concentrated runoff in drainage systems. Concentrated storm runoff from the pit surrounds and infrastructure areas is erosive, causing sheet, rill and donga erosion features.
- River diversions also change the overall gradient and therefore the flow rates and impact flood discharge and erosion/sedimentation patterns at the site and downstream.

#### **5.5 Potential Risks with regard to benefits for the social environment**

- No positive and transparent relationships with stakeholders and not maintaining communication channels – not providing stakeholders including government authorities with relevant information as per legislative requirements.
- Not undertaking environmental management according to approved EMP and plans and no auditing of the environmental management system.
- Disturbance to sensitive environments such as land with historical or conservation value, urban areas, wetlands or rivers, high potential agricultural land, transport infrastructure, power transmission lines. Slow continuous damage to habitat e.g. wood collection are typical impacts on adjacent areas.

- Staff losing their jobs - mine closure can have devastating effects on communities that are reliant on mine-based income Job losses of secondary industries, businesses and contractors Contractual agreements with service providers surpassing mine closure date
- Closure standards not accepted and/or are changing. Mine closure being jeopardised by other land uses
- Poorly defined transition from mining to farming activities within different legislation
- Mine closure stalled due to non-compliance with South African legislation (national, provincial and local)
- Insufficient funds for complete rehabilitation

### **5.6 Potential Risks with regard to aesthetic impact**

Terrain morphology plays a critical role in defining the visual envelope of mining developments and can either reduce or enhance visual impact. Apart from visual intrusion there is also the risk of reduced sense of place. Visual intrusion impact of mining activity on nearby roads, homesteads, settlements, tourist sites.

- Visual disturbance from the public road views – excavations or overburden dumps blocking the view. Large buildings, colour contrast of disturbed areas against adjacent veld or dust emission plumes
- Nuisance effects of air emissions (dust) no implementation and maintenance of dust monitoring programs accompanied by dust suppression activities if required.
- Accumulation of spoils from rock saws (fines) can expose highly erodible fine sediment to wind transport and lead to dust generation and dispersal. Dust can retard vegetation growth and reduce the palatability of vegetation.
- Dust generated on haul roads reduces visibility in opencast pit, representing a safety hazard.
- The cumulative effect of a raise in the ambient noise levels or high noise levels in specific areas that exceed specified levels. Noise disturbance and light pollution as a result of night activities.
- Disturbance of archaeological sites not implement mitigating measures according to the archeological assessment. Progressive development can encroach upon or disturb archaeological sites, cultural heritage sites or graves.

## **6 AFTERCARE AND MAINTENANCE**

Maintenance of rehabilitated sites is often the difference between the ultimate successes or failure of rehabilitation and monitoring of rehabilitation will determine whether rehabilitation objectives and requirements are being achieved.

As the final phase in the project cycle, decommissioning may present positive environmental opportunities associated with the return of the land for alternative use and the cessation of impacts associated with operational activities.

Depending on the nature of the operational activity, the need to manage risks and potential residual impacts may remain well after operations have ceased. Examples of potential residual impacts and risks include erosion, slow recovery of vegetation, stock that has been abandoned (e.g. oil drums, scrap equipment) and old (unserviceable) structures.

The main closure objective is to hand back the rehabilitated properties in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof. The aim therefore is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required. Aftercare and maintenance required can only be identified post decommissioning and depending on success of rehabilitation and mitigating measures.

## **7 RISK ASSESSMENT**

### **7.1 Risk impact rating**

Following risk identification (section 4.4), the impact of each risk was evaluated. One way of evaluating the impact of a risk is to determine the probability, severity, frequency and duration of the risk. These are all valued separately and then combined to produce a risk impact; insignificant (1, green), medium (2, yellow) or significant (3, red). In some instances the impact of a risk was classified as uncertain due to lack of information.

For a risk with a rating of 3 (i.e. significant), strategies are put in place to reduce the risk to 1 (insignificant) or 2 (medium, provided that the risk can be controlled with management actions). To maintain the rating at 1 or 2, monitoring is implemented for a period of time to enable the confirmation of the risk as insignificant or as medium and under control.

Each risk is furthermore assessed for, decommissioning conditions (DC), and post-mining conditions (PM). Where a risk is only applicable to decommissioning (DC) related activities, a rating for the post-mining period is not provided. At the time of final mine closure an application will be made to DMR for a mine closure certificate only when all risks have been confirmed as insignificant or medium and under control via management actions.

#### **7.1.1 Evaluating the probability**

The probability of a (detrimental) environmental impact occurring depends on the controls which are in place to prevent or mitigate the impact (for example, monitoring, instructions and procedures, etc.) and the nature of substance which contributes to the impact. Combinations of descriptions for what are considered to be different levels of importance for controls and substances involved can be integrated in the evaluation of the probability of an activity taking place, which can then be assessed.

There are no standard methods of evaluating the probability of occurrence. All methods used rely on some form of subjective judgment and, therefore, agreed criteria have to be used in the evaluation. Values are assigned for the probability of occurrence of the relative strength of the factors involved to each of the criteria. Three evaluation ratings are used, viz. 1 for unlikely, 2 for could be/could happen/unknown, and 3 for definite/has happened/highly likely.

#### **7.1.2 Evaluating the severity**

In evaluating the severity of a potential impact there are various criteria that can be applied to determine the level of risk associated with the consequences of an action occurring. These are the quantity of material/substance released and the probable size of the covered area or possible spread of impact. Combinations of descriptions for what are considered to be different levels of importance for the criteria listed above can be integrated.

Values are assigned for the severity of the relative strength of the factors involved to each of the criteria. Three evaluation ratings are used, viz. 1 for insignificant, 2 cause for no mine closure certificate to be issued/hazard to quality of life/unknown, and 3 for loss of life/permanent environmental impact.

#### **7.1.3 Evaluating the frequency**

When evaluating the frequency of a potential impact any repetitive, continuous or time-linked characteristics of the impacts are taken into account. Values are assigned for the frequency of the factors involved to each of the criteria. Three evaluation ratings are used, viz. 1 for once off, 2 for intermittent, and 3 for ongoing/continuing/usually.

#### **7.1.4 Evaluating the duration**

The duration of a potential impact is based on the duration of the impact should the risk realise, i.e. the duration could be short-term, medium-term, long-term or permanent. Values are



assigned for the duration of the factors involved to each of the criteria. Three evaluation ratings are used, viz. 1 for an instant/point in time, 2 for temporary/ intermittent, and 3 for forever.

The final risk evaluation is a combination of the probability, severity, frequency and duration ratings. The risk rating for the different risks in the mine closure process may be determined in each case for a particular impact. Values are calculated, as a function of the probability, severity, frequency and duration for different risks. The individual scores are added and a risk impact is assigned. The calculated sums of the possible permutations of probability, severity, frequency and duration range from 4 to 12. Combinations with a sum total of 6 and less were rated as insignificant, while those rating 10 and higher were defined as significant. Risks with ratings in between 6 and 10 have medium outcomes. The final risk evaluation levels are listed together with their associated mitigating actions in the tables in section 6.2 for each of the closure objectives.

## 7.2 Risk Mitigation and Closure objectives

Internationally, there seem to be three schools of thought with regard to closure objectives:

- “What the affected community wants, the affected community gets” – that is, the key focus is on providing the end product requested by the affected communities, rather than focusing on the previous status quo of the receiving environment
- “Restoration of previous land use capability” – the original thought process in the South African context, because mining often occurs on land with high agricultural potential
- “No net loss of biodiversity” – the focal point in the ICMM/IUCN dialogue sponsored guidelines for mining and biodiversity, and of many mining corporate policies.

The thought process for the closure of this operation is based on the last two. In addition to the goals and objectives for final decommissioning and mine closure the vision for the post closure land form is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required. The vision is to ensure that the affected environment is maintained in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof and that the aesthetic value of the area will be reinstated.

For the vision to be realised the objectives and associated risk management strategies and mitigating measures described below needs to implemented, monitored and evaluated.

Risk management strategies were identified for the potentially significant risks, while data collection and analysis programmes were pursued to evaluate the uncertain risks.

The aim with risk mitigation actions is to over time manage significant (red) and medium (yellow) risks to become insignificant (green), or at least medium and under control with management actions. Once achieved, a risk will continue to be monitored to confirm its insignificance rating of green (1) medium and controlled rating of yellow (2) as part of aftercare and maintenance as discussed in section 4.

The closure process involves a series of actions, executed over a number of years as indicated in the annual closure plans, with continual monitoring, review and remedial actions (if required). Identified and assessed risks feed into mitigation actions (or primary tasks) of which successful implementation result in achievement of the mine closure goals and objectives.

The three key mine closure objectives are elaborated on in more detail and in context of the relevant risks below (each of the objectives are supported by several key aims):

- Objective 1 - To create a safe and healthy post-mining environment

- Safe excavations
  - Slope stability of remaining excavation
  - No potentially dangerous areas secured if required
- Limited residual environmental impact
  - Develop a landscape that reduces the requirement for long term monitoring and management
  - No surface and/or groundwater contamination
  - Waste management practices not creating or leaving legacies
- Objective 2 - To create a stable, free draining post mining landform, which is compatible with the surrounding landscape
  - Economically viable and sustainable land, as close as possible to its natural state.
    - Prepare area to promote natural re-establishment of vegetation that is self-sustaining, perpetual and provides a sustainable habitat for local fauna and successive flora species
    - Prevent long term changes in land use by implementing prompt rehabilitation and maintenance of disturbances when possible as part of annual rehabilitation plan.
  - Stable, free draining post mining landform
    - Prevent alteration or diverting natural drainage lines and reduced natural runoff.
    - Prevent concentration of runoff, mixing of clean runoff with contaminated runoff and creation of large open water bodies.
- Objective 3 – To provide optimal post-mining social opportunities
  - Optimised benefits for the social environment
    - Positive and transparent relationships with stakeholders and maintaining communication channels, providing stakeholders including government authorities with relevant information as per legislative requirements.
    - Undertaking environmental management according to approved EMP and Closure plans and regular auditing of the environmental management system.
  - Minimal negative aesthetic impact
    - Mitigate the nuisance effects of air emissions (dust), visual intrusion and the cumulative effect of a raise in the ambient noise levels
    - Prevent disturbance of archaeological sites and implement mitigating measures according to the archeological assessment.

The legal framework within which all the above lies entails:

- Defining and meeting closure standards.
- Complying with legislation.
- Sufficient financial provision for mine closure activities.
- Monitoring and plan for latent environmental impact.

The closure process involves a series of actions, with continual monitoring, review and remedial actions (if required). Identified and assessed risks feed into mitigation actions (or primary tasks) of which successful implementation result in achievement of the mine closure objectives and aims.

A narrative description is provided for each key objective in the following paragraphs. Risks associated with each closure objectives are discussed with their mitigation actions and believed impact rating at closure. In addition, the closure standard for each key aim is listed and quantified. Financial provision is made in section 7 to deal with these mitigating measures in case of temporary closure or sudden closure during the normal operation of the project or at final planned closure.

### 7.2.1 Create a safe and healthy post-mining environment

#### a) Safe post mining landscape without long term monitoring and management

Steep highwalls are potentially unstable and failure can impact areas away from the opencast pit rim. The stability of the rock mass is determined by the three-dimensional orientation and spacing of joint planes, shear zones or faults and fracture planes and their intersection with the natural structural grain of the rock or landforms. The structural properties required of a successful dimension stone is for a massive and competent ore body without faults and fractures and any remaining highwall or slope will therefore be stable. The risks associated with a safe post mining landscape is as follow:

- Collapsing slope(s) of mine pit can be detrimental to the safety and health of humans and animals.
- Potentially dangerous areas like deep mine pit or equipment left behind and uncontrolled access to a potentially unsafe post-mining area
- Post mining topography not compatible with original landform.
- Unsafe erosion gulley's

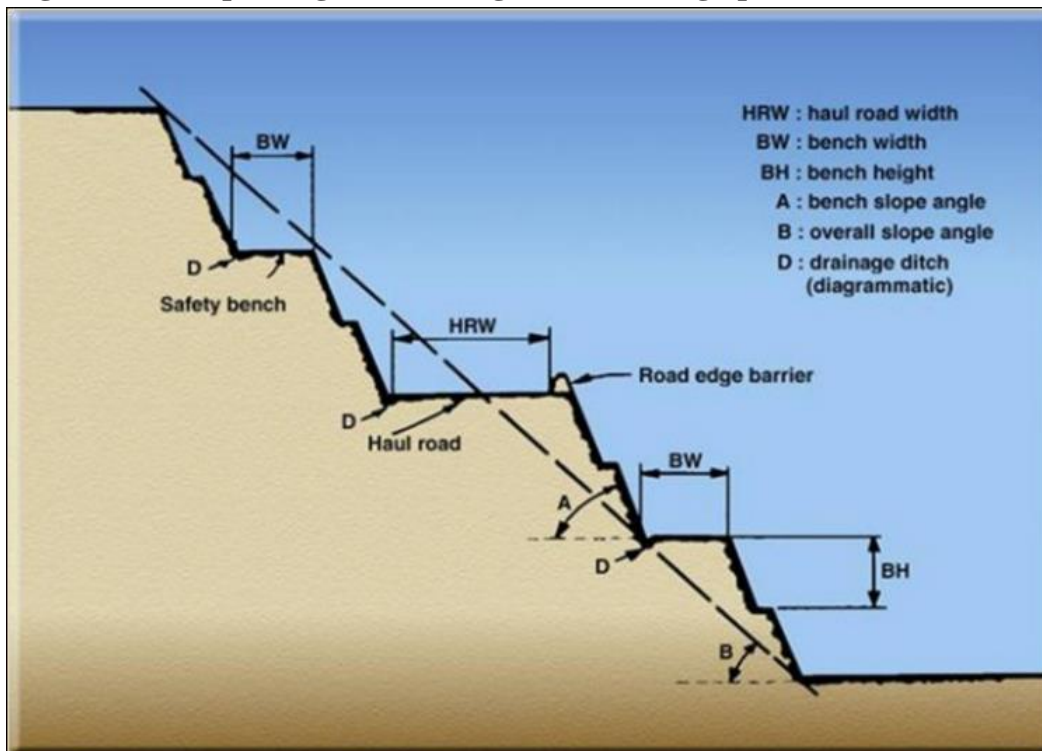
The focus of topographic rehabilitation may not be obvious at the time of mine planning and must be addressed as the mine develops and the CP must be reviewed periodically for continued relevance in the light of changed mine path or long-term plans.

Implementation of the following tasks to manage the risks associated with high wall stability of the quarry and slope stability of the waste dump will ensure a safe post mining landscape without the requirement for long term monitoring and management. Regular inspections and audits will be used as management system to ensure compliance.

- Due to cutting with circular saws smaller and vertical benches of average 1m are created that can be planned so as to prevent an excessive highwall remaining.
- During construction terrain form will be used to shield opencast pit from developed or sensitive areas as protection in the unlikely event of highwall or slope collapse.
- During production the height of highwalls will be reduced by separating benches to increase stability.
- Overall slope angle between 60° and 70° will fit in with the natural topography of the mountainous terrain and due to the massive and competent nature of the ore body will still be stable (Figure 1).
- At final closure geotechnical investigations will identify unstable rock conditions, slopes that require support in the short-, medium- and long-term. Geotechnical slope stabilisation methods including concreting (gunnite), rock bolting, wire mesh restraint, bench wrecking to lower highwalls, rehabilitative blasting etc will be investigated and implemented during decommissioning.
- A row of blocks will be packed in a straight line at the base of the high wall to reduce the overall height as an additional preventative measure, minimizing safety risks. After the rehabilitation phase no maintenance will be required as the blocks will be permanent fixtures that can only be moved via front end loaders.
- The final slope of the pit floor would be towards the drainage channel to prevent collection of storm water. During operations pump rainwater that collects in the pit and store for use as process water or dust suppression.

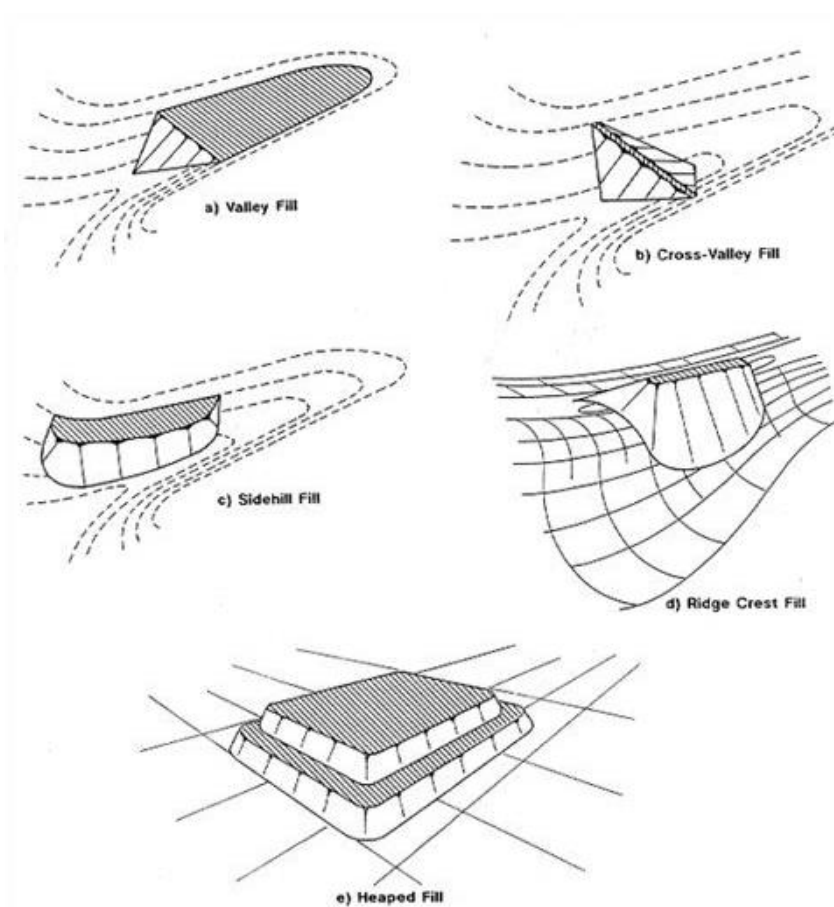


**Figure 1: A simple diagram showing different design parameters**



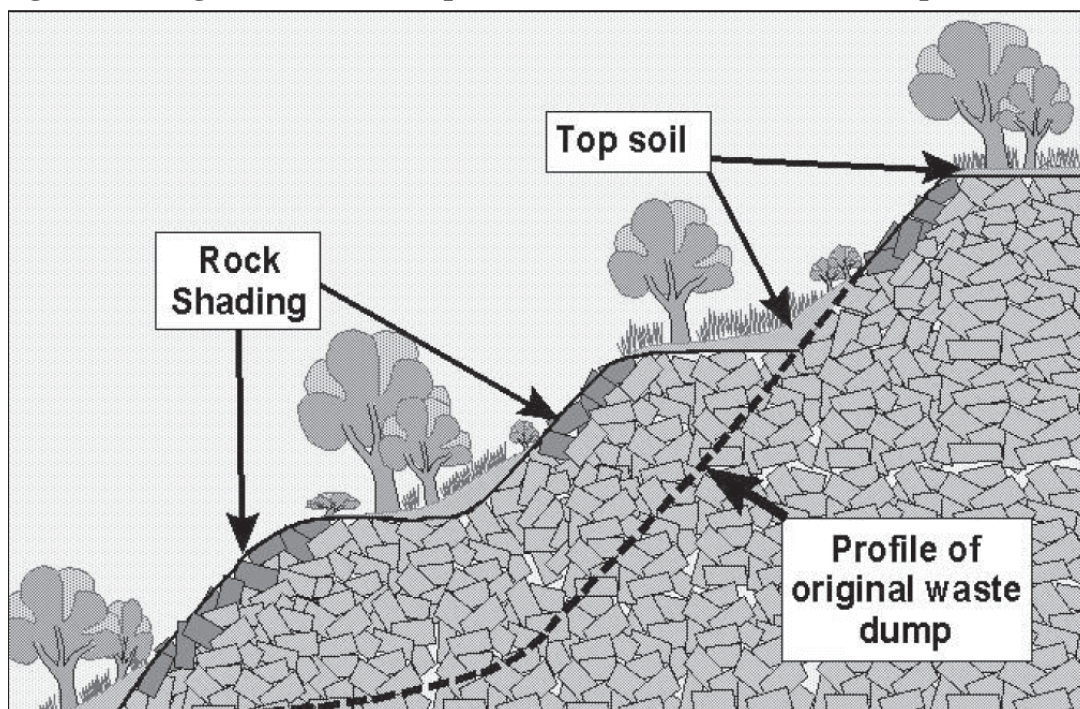
- Any remaining high wall will be fenced off at final closure in order to deter people or animals from falling over.
- At final closure of the operation all remaining product (blocks) from the demarcated stockpile will be restored to pit wherever possible to reduce highwall height and provide surface for rehabilitation or used to fill any remaining deep excavations if any.
- Waste dumps must be designed to meet minimum slope stability and safety standards and vegetated with reduce erosion and runoff.
- In view of the fact that the mountainous terrain consist of natural depressions along the slope, and the limited topsoil available the best option for waste dumps is filling and levelling the top of these natural depressions “valley fill” (Figure 2). The natural angle of repose  $37^\circ$  for granite waste dumps is compatible with the natural rocky terrain with steep slopes and no terracing will be required.
- Waste dumps on the sides of kopjes “sidehill fill” (Figure 2), which have large slopes will be terraced once the dump has reached its final profile at the top level, by dumping additional material along the sides at progressively lower levels, and developing these terraces at differing angles. Final reclamation will thus only occur toward the end of the life of the quarry.
- In the case of waste dumps in the valleys “heaped fill” (Figure 2), excavations with the final designed perimeter of the dump will be created to obtain cover material for the top of the dumps and profiling the slope of historic dumps to be re-used. The excavations will serve as a base for extending the waste dump. Thereafter, dumping will proceed above surface on the top of this buried dump at successive tiers with appropriate height around 6-10m, leaving terraces of 6m wide, and working from the perimeter toward the centre. This will allow for reclamation of the outside profiles at a much earlier stage, resulting in very little outstanding reclamation toward the end of the life of the dump.

**Figure 2: Mine dump Classification**



- The natural red-brown colour of rock is a result of weathering of the outer 1-2mm of the rock surface, and the natural process can be mimicked by coating the rock surface with ferric chloride ( $\text{FeCl}_3$ ) available commercially in large quantities at a reasonable price, as it is extensively used in sewage treatment. Concentrations of around 40% gave the best results and is ideal, as one of the products supplied commercially for sewage treatment is a 43% concentration of contained  $\text{FeCl}_3$ . Freshly sprayed areas need several days to dry as rain within the first 24-48 hours after spraying caused much of the ferric chloride to be washed off, requiring that the work be repeated. Due to these factors, it is preferential that spraying of rock surfaces with ferric chloride be conducted during the dry season. However, care must be taken, as experience has shown that where there is excessive dust collection on the rock surfaces, such as is the case with dumps close to haul roads, haematite tends to form around the dust particles rather than on the rock surface, resulting in substantial loss of coverage when the rains wash off the dust. This can be overcome by washing down these surfaces with water several days prior to spraying, or by treating these areas during dry window periods within the rainy season.
- Mitigation of the visual impact of “heaped fill dumps” and “sidehill dumps” will include rock shading and limited topsoil application to the slope and revegetation on the top of the dump as illustrated in figure 3 below.

**Figure 3: Mitigation of visual impact of dimension stone waste dump**



b) Create a healthy post-mining environment with no residual environmental impact  
Granite mining methods themselves generally have a low impact on the surrounding environment due to the need to carefully extract large blocks or slabs without damage to the stone. Recent advances in dimension stone mining technology have also had the effect of reducing environmental impacts. Particularly in granites, improvement in diamond wire sawing efficiency and rotary saws has significantly reduced the use of explosives in the extraction of blocks. This has resulted in higher recovery of saleable blocks and therefore less waste to be disposed of, as well as reducing the emissions of blasting gases (SO<sub>2</sub> and NO<sub>x</sub>), noise and ground vibration. The risks to be dealt with at final closure include:

- Post mining landscape that increase the requirement for long term monitoring and management.
- Unwanted ruins, buildings, foundations, footings and waste management practices creating or leaving legacies.
- Sub-surface infrastructure remaining behind, limiting the intended post closure land use including footings and foundations and power supply and water installations including pumps and pipelines.
- Equipment and other items used during the mining operation left behind.
- Incomplete removal of re-usable infrastructure.
- Rubble from demolished infrastructure left behind.
- Waste classes not kept in separate streams and incomplete removal of waste
- Vehicle wash bays and workshop facilities produce petrochemical and solvent contaminated runoff.
- Sanitary conveniences, fuel depots or storage facilities of potentially polluting substances can contaminate surface water.
- Oil fuel leaks onto virgin soil through the earthmoving and transport equipment and machinery or spillage of fuel during transfer from fuel bowser to equipment in the field.
- Inadequate capping or sealing of the boreholes – can lead to infiltration of potentially contaminated surface water leading to chemical or biological contamination of groundwater.



- Drainage of benches and concentration of rainfall leads to creation of large volume open water bodies in worked out pit and can lead to increased groundwater recharge and potential regional impact of low quality water.
- Pumping of process water from the pit sump can discharge poor quality water exceeding minimum standards.

Maintaining organization and general tidiness at the quarry allows for efficiency in daily task performance, creates a less hazardous work environment, and portrays a sense of corporate responsibility to site visitors, potential customers, and neighbours.

Waste management will be implemented throughout the life of the mine and will be audited as part of the annual performance audit and will also form part of final closure.

The waste and residues from various mines falls into a number of categories, and these can include:

- Waste that is collected within the settling dams;
- Waste rock from the mining process;
- Overburden, cover, and/or "soft" material;
- Other non-specification waste such as sub-economic lower grade ore;
- Industrial waste (i.e. including hazardous wastes and oils and greases);
- Recycling and reusing materials may reduce garbage haul fees or generate income through the sale of scrap metal and old equipment. Domestic waste (i.e. waste that is generated from the accommodation and offices);
- Waste water (i.e. including process water and water from sanitation processes, as well as sewage sludge); and

The following activities to manage the risks associated with Final Closure and demolition activities will ensure that waste management practices do not create and/or leave legacies and will limit the residual impact of mine closure. Regular inspections and audits will be used as management system to ensure compliance.

- Waste that is collected within the settling dams;
  - The physical properties required of a successful dimension stone and due to the requirement for inert materials which are not affected by weathering (and in today's context, the effect of severe chemically polluted atmospheric environments), dimension stone residues are typically benign from a pollution point of view.
  - Water used for cooling of saw blades together with the fine residue (cutting spoils) will be collected in a series of settling dams from where the water will be re-used.
  - Sludge collected within the settling ponds will be disposed of within the waste rock dump.
- Waste rock from the mining process;
  - Like natural aggregates, dimension stone is used in its natural state, and does not require concentration and extraction from an ore. It is these latter two processes that result in significant environmental impacts such as acid mines drainage and other toxic effects associated with many of the metal extraction industries.
  - The focus with regard to all waste should be to reduce, recover, recycle and reuse. Every effort must be made to minimise waste. This is achieved by understanding and changing processes to reduce and prevent waste. This is also known as process or resource efficiency.
  - Waste or un-salable blocks will be dump in the demarcated waste dump on a regular basis (refer previous section).
  - Bury all surplus loose, isolated waste rock and un-saleable blocks in designated sub surface pits and cover with growth medium or move waste to the designated mine residue deposit site.

- Waste or low grade blocks can be subjected to secondary processing by cutting into smaller blocks, used as refill or landscaping, crushed for other applications (such as concrete production), or otherwise dealt with responsibly.
- Overburden, cover, and/or “soft” material including topsoil;
  - Stored overburden in the form of bouldery rubble and other stone waste should not be left in piles, and should be used to cover waste dumps.
  - Soil removal creates permanent impacts that can be mitigated through restoration of soil cover, although the significance of the impact remains high. This is most apparent in steep rocky slopes where there is thin soil cover of limited areal extent which is seldom removed and stockpiled ahead of mining. However, rocky post-mining slopes can usually be rehabilitated with fine waste rock or tailings to provide the ecological niche provided by the thin patchy lithosoil (rocky soil).
  - Remove and stockpile 300mm topsoil in berms or heaps less than 1,5m high and turn soil or re-use every six months. Do not use as permanent stormwater control feature.
  - Remove and stockpile topsoil from roads, building platforms and stockpile areas prior to construction for use to restore disturbed areas. To ensure long-term stability, the restored soil cover should attempt to mimic the pre-mining distribution of soil texture and thickness.
  - Contaminated soil must be treated by first removing the source of contamination - removing the source of contamination should allow the system to recover without further cleanup required.
  - Petrochemical spillages to be collected in a drip tray and drum to store excavated spill affected soil for disposal at a registered facility or onsite treatment.
  - The most promising techniques for in on-site treatment involve bioremediation. Bioremediation involves the use of microorganisms to destroy hazardous contaminants.
- Other non-specification waste such as sub-economic lower grade ore:
  - Any product stockpiles left or oversize builders must be removed and used to backfill excavations or to slope remaining high walls.
  - Waste or low grade blocks can be subjected to secondary processing by cutting into smaller blocks, used as refill or landscaping, crushed for other applications (such as concrete production), or otherwise dealt with responsibly.
- Industrial waste (i.e. including hazardous wastes and oils and greases);
  - Distinguished between farming and mining infrastructure and waste in consultation with landowner
  - Separation of wastes into classes will ensure that waste is disposed of safely and according to the correct procedure. In order to ensure that waste classes are kept in separate streams, communication will be passed on and people will be trained on the different waste classes.
  - Unwanted steel, sheet metal and equipment needs to be stored in a demarcated salvage yard.
  - Unwanted steel, sheet metal and equipment in the salvage yard will be sold or disposed of as scrap metal. Recycling and reusing materials may reduce garbage haul fees or generate income through the sale of scrap metal and old equipment.
  - All steel structures and reinforcing will be discarded or sold as scrap.
  - All equipment and other items used during the mining operation needs to be removed from the site.
  - Used oils / hydrocarbons fuels / liquids are to be collected in sealed containers (stored on concrete slabs) and removed from site for recycling by a reputable company.
  - All waste in the temporary storage area for used lubrication products and other hazardous chemicals will be disposed of at a collection point from where it will be collected by a waste recycling company.

- Mobile generators will supply electricity to the machinery. Generator bays will be constructed with the necessary pollution control measures (drip trays).
- Clean out content of oil traps and dispose of waste at registered and purpose designed landfill sites.
- Hydrocarbon contaminated sludge (collected in oil traps) - Removed from the oil traps and removed from site for recycling (if possible) or disposal at a suitably permitted facility.
- All temporary waste storage areas needs to be cleaned out and waste removed.
- Tyres to be return to supplier or a company that uses old tyres for making door mats, shoes, swings, etc.
- Batteries to be return to supplier or dispose at a permitted hazardous waste facility.
- Fluorescent tubes to be collected in sealed containers (stored on concrete slabs) and removed from site for disposal at a permitted hazardous waste facility.
- Chemical containers to be returned to supplier or disposed of at a legal, permitted facility that is capable of disposing of the waste. (DO NOT sell chemical containers to workers or communities).
- Laboratory waste (chemicals) - Returned to supplier or disposed of at a permitted facility that is capable of disposing of the waste.
- Industrial chemicals (laboratory waste) - Returned to supplier or disposed of at a permitted facility that is capable of disposing of the waste. These liquid wastes cannot be disposed of on the waste dumps.
- Domestic waste (i.e. waste that is generated from the accommodation and offices);
  - Domestic waste - Separated at source into recyclable products. These must then be removed and recycled by recognised contractors. (Note that the mine is responsible for the waste from cradle to grave).
  - Disposal at a registered and officially permitted commercial or municipal landfill site is the most cost effective option for materials that cannot be recycled.
  - Domestic waste generated by workers needs to be sorted and all biodegradable waste must be stored in separate drums provided for.
  - This biodegradable will be dumped in a landfill provided for onsite.
- Waste water (i.e. including process water and water from sanitation processes, as well as sewage sludge)
  - Equipment used in the mining process will be adequately maintained in the workshops of the company so that during operations it does not spill oil, diesel, fuel, or hydraulic fluid.
  - By keeping contaminated and clean water separate and establishing controlled runoff washing bays, the flow and end destination of decontamination washing water will be controlled.
  - A Standard French drain system will be developed for sewage and grey water disposal.
  - Although erosion and runoff are natural processes it should be managed by maintaining topsoil in any areas not in use and maintaining maximum existing vegetation coverage.
  - Slow stormwater runoff with contoured, low-gradient drains and channels, as well as retention ponds. A series of ponds may also be used to remove sediment and other contaminants from water before reuse or reintroduction into natural waterways.
  - Stormwater diversion and erosion control contour berms separate clean and contaminated water systems around the pit and infrastructure areas.
  - Provision must also be made for efficient storm water control to prevent erosion of roadways.
  - Sewage - No sewage outfall may be located within 100m of a water feature. No sewage may be discharge into a water body.



- Other mitigating with regard to residual environmental impact
- Implementing screening as part of the cleaning activities before materials are moved from the mine.
- The infrastructure area will be screened for petrochemical spills and cleaned and waste from the temporary storage facility will be removed and the area cleaned.
- The compacted salvage yard, lay down and movement areas will be screened for petrochemical spills and cleaned before it is ripped and levelled.
- Redundant structures, buildings and civil foundations (down to one meter below surface for subsurface infrastructure) will be removed for use elsewhere or demolished and discarded.
- All redundant infrastructure and services needs to be demolished including ruins, buildings, foundations, footings.
- Building rubble will be used as backfill in excavations or removed from site in the absence of excavations.
- Remove all power and water supply installations not to be retained by landowner in terms of section 44 of the MPRDA.
- Removing underground infrastructure to one meter below surface.
- Excavations created by removing subsurface infrastructure needs to be filled, levelled and compacted.
- Final walk through of complete mining lease area to ensure no mining related waste and of re-usable infrastructure remain on site.
- As part of this phase training of personnel in the implementation of the Closure Plan will be done and the implementation of the environmental awareness plan will be an ongoing process.

The above risks and their levels are listed together with their associated mitigating actions in Table 1. At the time of this review no significant risks were identified. Only one medium level risk were identified, the possibility of waste management practices creating and/or leaving legacies.

**Table 1: Risks, risk levels and mitigating actions in terms of a safe and healthy post-mining environment**

Risk	Risk Rating	Mitigation Actions
Collapsing slope	DC	Limit height of high walls Design stable slopes by creating benches. Re-shaping waste dump slopes to stable conditions following identification of instable areas through observations and regular inspections
	PM	
Uncontrolled access to a potentially unsafe area	DC	Use terrain form to shield quarry from developed. Fence dangerous areas. Remaining product (blocks) restored to reduce high wall. Limiting and controlling access while rehabilitation activities are in progress
	PM	
Post mining topography not compatible with original landform	DC	Mountainous terrain with natural depressions provide for waste dumps to blend in with topography. Natural angle of repose 37° for granite waste dumps is compatible with the natural rocky terrain with steep slopes.
	PM	Waste dumps in the valleys will be partially buried and surface deposition will create artificial kopjes compatible with the natural rocky terrain with steep slopes
Erosion gulley's		Refer to objective 2 productive land use
Post mining landscape that increase the requirement for long term monitoring and management	DC	Implementing waste management as per current approved procedure.
	PM-NA	

Incomplete removal of waste	DC	Final walk through of complete lease area to ensure no mining related waste remaining on site.
	PM	
Waste classes not kept in separate streams	DC	Communication and training on the importance of separating waste streams
	PM-NA	

Documentation and monitoring results will be provided as objective evidence of achieving the objective of minimum legacies as listed in Table 2. The criteria with the contents of these documents must comply with are also given in this table.

**Table 2: Objective evidence and closure criteria for safe post-mining environment**

Closure objective	Document scope	Author	Success criteria (standard)
Slope and High wall stability	Inspection of the post-mining areas with the objective to identify unstable areas and formation of erosion gulley's	Independent EAP	Post-mining area declared stable by DMR mine health and safety
Secured potentially Dangerous post-mining sites	Inspection of the post-mining surface area with the objective to identify unsafe areas	Independent EAP	Post-mining area declared safe by DMR
Waste management practices do not leave/create legacies	Inspection of the post-mining surface area with the objective to identify pollution	Independent EAP	Post-mining area declared safe by DMR
	Assessment of the completeness of removal of mine waste	Independent EAP	Final performance assessment report declares 100% removal of waste and equipment

### 7.2.2 Create a stable, free draining post mining landform

a) Economically viable and sustainable land, as close as possible to its natural state.

With granite mines complete disruption of the surface always occurs, which affects the soil, fauna, flora and surface water, thereby influencing all types of land use. Opencast mining and related infrastructure is a permanent destruction and rehabilitation cannot restore all pre-mining habitats. Granite quarries cannot be completely refilled and form permanent depressions that must be accommodated through imaginative utilisation during the post-closure period and the residual impact of open-pit mining is usually a completely different land use. Risks associated with economically viable and sustainable land include:

- Uncontrolled expansion of mining footprint by not restricting the area disturbed by mining and the associated activities/infrastructure - loss of land with agricultural potential. Uncontrolled development of roads - existing farm roads not used for mining operations and redundant internal roads left behind. Dual used roads still needed by the landowner and fences not maintained or repaired.
- Post mining landform not compatible with the surrounding landscape and not capable of a productive land use that achieves a land capability equal to that of pre mining conditions
- Long term changes in land caused by not implementing prompt rehabilitation and maintenance of disturbances when possible as part of annual rehabilitation plan.
- Unsuccessful rehabilitation can reduce the post-mining land use options. Rehabilitated areas could be too unstable to support post-mining land use objectives compatible with surrounding areas.
- Disturbance of agricultural potential and subdivision of high potential arable land into uneconomic farming units. Inadequate planning or loose development can subdivide high potential land or habitats into un-viable small areas.

- Disturbance of ecology due to loss of habitat and cumulative impact of illegal collecting or land use during long-term or life of mine can degrade areas and reduce the viability of adjacent areas. Inadequate control of alien species can result in establishment of populations or seed sources that threaten adjacent areas.

The activities and actions associated with achieving a post mining landform, which is compatible with the surrounding landscape and which is capable of a productive land use that achieves a land capability equal to that of pre mining conditions are listed below. It is important to note that for the mine to meet this objective it is imperative that its other key objectives, viz. a safe post-mining area with limited residual impacts and optimal post-mining social opportunities are met. Should the attenuation measures for prevention of pollution as described in section 6.2.1 be implemented, the effect on sustainability will be insignificant. For safety, monetary, and environmental reasons, extreme care must be taken to minimize the operational footprint at the quarry site. Proper management can curtail occupational hazards and environmental degradation, ultimately creating financial savings. The following maintenance practices will make site closure less labor intensive (and thus less fiscally demanding) and will allow a faster recovery rate for the local ecosystem.

- Focus developments and avoid un-necessary subdivision of land and activities that could be sited on already disturbed land. Take into account developments in surrounding areas and design post-mining land use options to support and enhance long-term development options
- Rehabilitation must ensure long-term stability and not compromise post-mining land use objectives.
- Plan to focus developments through multi-use options and avoid splitting land and habitats. Consolidate development areas and develop multi-use options or infrastructure corridors for roads, pipelines, power and communication links.
- Minimising footprint of disturbed areas including stockpile platforms and loading and hauling areas.
- Minimise the loss of land with agricultural potential: minimize footprint of disturbances to facilitate recovery of degrading patches into active patches through colonization of the patch by dispersing species (patch dynamics)
- Minimise loss of vegetation within the disturbance footprint: scarifying of all compacted areas as soon as possible for natural plant succession. Unnecessary destruction of vegetation should be avoided by ensuring that traffic and personnel movement be restricted to demarcated areas. No traffic should be allowed on the rehabilitated areas.
- Movement of vehicles will be restricted to demarcated areas so as to keep the footprint of the mining operation to the absolute minimum. Movement of equipment must be restricted to existing roads and no ad hoc driving or turning outside demarcated loading and hauling areas will be allowed.
- Recreate habitats where possible or structure altered landscapes to be compatible with regional habitat mosaics to resist water and wind erosion of soils.
- Minimise disturbance of ecology due to loss of habitat and noise/visual/dust
- Excavations created to obtain subsoil for working platforms will be backfilled with waste rock. The excavations will then be covered with top soil and allowed to re-vegetate naturally resulting in an even depression with no residual impact.
- Surplus soil from the excavation will be stored to cover the waste dumps.
- All compacted areas due to stockpiling, loading and hauling will be ripped with erosion control measures and all roads not required by landowner must be ripped (30cm deep) and repairs to all fences and gates.



- Monitoring and management during the life of a mine is critical to ensure that undisturbed areas are not impacted by the mining activities that disturb adjacent land and that plants from these areas are not illegally removed and utilised.

b) Stable, free draining post mining landform.

Opencast pit creates area of lowered topography that can act as a sump for storm water runoff and intersects groundwater and if the operation extends to depths below the water table, it will affect the near-surface groundwater. Apart from reducing natural recharge to the shallow and deep groundwater zones, the increased runoff and altered storm hydrograph will also impact areas downstream or downslope where the flow is concentrated. Risks relating to a free draining post mining landform is as follow:

- Impact on surface water through modification of infiltration rates by increasing the extent of hardened surfaces.
- Inadequate topsoil restoration or creation of un-natural surface topography or slope form which could impact lower or adjacent slopes due to increased runoff velocity.
- Altered storm water runoff response due to large impervious areas and concentrated runoff in drainage systems. Concentrated storm runoff from the pit surrounds and infrastructure areas is erosive, causing sheet, rill and donga erosion features.
- River diversions also change the overall gradient and therefore the flow rates and impact flood discharge and erosion/sedimentation patterns at the site and downstream.

The activities and actions associated with achieving a free draining post mining landform are listed below. It is important to note that for the mine to meet this key objective it is imperative that its other key objectives, viz. a safe post-mining area with limited residual impacts and optimal post-mining social opportunities are met. Should the attenuation measures for prevention of pollution as described in section 6.1 be implemented, the effect on soil and water will be insignificant. The most important of these is that:

- To prevent significant negative effects arising from changes in post-mining surface water quantities, the post-mining topography at the excavations will be adjusted where possible to minimise the effect on water flow and increase potential for re-vegetation.
- Actions to mitigate the risk of erosion will be through implementation of practices such as leaving the profiling contours.
- Mining must be conducted in such a manner as to ensure that natural drainage lines are not destabilized and that surface and ground water quality is not impaired.
- Prevent attenuating or diverting any of the natural flow.
- Minimise risk of erosion from either increased base flow or mining operations followed by prompt rehabilitation and maintenance of erosion events. Provision of efficient storm water control to prevent erosion of steep slopes and roadways and elsewhere are required.
- Initiate catchment management to control and reduce erosive runoff containing suspended sediment. Create and maintain clean water drainage systems to isolate contaminated areas and separate clean and dirty water systems so that neither can interact more than one in 50 years.
- Implement DWAS best practice guidelines with regard to water Reuse and Reclamation to encourage the reuse and reclamation of water in order to ensure that scarce water resources are used in an effective way that is beneficial to the environment by preventing pollution and deterioration in water quality; conserve water resources by reducing consumption and minimising losses; maximise water reuse opportunities; and ensure the sustainability of water usage across the mine's life cycle.
- Implement DWAS best practice guidelines with regard to Storm Water Management to address all impacts of the mine's operation on the hydrological cycle and vice versa, during the entire life cycle of the mine by keeping water clean; collect and contain dirty water; sustainability over mine life cycle; and consideration of regulations and stakeholders.

A summary of the above risks and their mitigation actions is given in Table 3. Also shown in this table is the level of each risk. At the time of this review no significant risks were identified. Only one medium level risk were identified the possible changes in the surface water quantities and flow patterns leading to erosion on the disturbed areas. When more information becomes available, appropriate actions will be taken if proved necessary.

**Table 3: Risks, risk levels and mitigating actions in terms of a stable, free draining post mining landform, which is compatible with the surrounding landscape**

Risk	Risk Rating	Mitigation Actions
Uncontrolled expansion of mining footprint by not restricting the area disturbed by mining and the associated activities/infrastructure - loss of land with agricultural potential	DC	Plan to focus developments through multi-use options and avoid splitting land and habitats. Consolidate development areas and develop multi-use options or infrastructure corridors for roads, pipelines, power and communication links.
	PM	
Post mining landform not compatible with the surrounding landscape and not capable of a productive land use that achieves a land capability equal to that of pre mining conditions	DC	Minimise the loss of land with agricultural potential: minimize footprint of disturbances to facilitate recovery of degrading patches into active patches through colonization of the patch by dispersing species (patch dynamics)
	PM	Minimise loss of vegetation within the disturbance footprint: scarifying of all compacted areas as soon as possible for natural plant succession. Unnecessary destruction of vegetation should be avoided by ensuring that traffic and personnel movement be restricted to demarcated areas.
Long term changes in land caused by not implementing prompt rehabilitation and maintenance of disturbances when possible as part of annual rehabilitation plan.	DC	Monitoring and management during the life of a mine is critical to ensure that undisturbed areas are not impacted by the mining activities that disturb adjacent land and that plants from these areas are not illegally removed and utilized. Implementing of annual rehabilitation plan
	PM	
Disturbance of agricultural potential and subdivision of high potential arable land into uneconomic farming units. Inadequate planning or loose development can subdivide high potential land or habitats into un-viable small areas.	DC	Focus developments and avoid un-necessary subdivision of land and activities that could be sited on already disturbed land. Take into account developments in surrounding areas and design post-mining land use options to support and enhance long-term development options
	PM	
Impact on surface water through modification of infiltration rates by increasing the extent of hardened surfaces	DC	Create contours on excavation slopes. Monitoring through observations and regular inspections. Implementing final topography changes if required
	PM	
Inadequate topsoil restoration or creation of un-natural surface topography or slope form which could impact lower or adjacent slopes due to increased runoff velocity.	DC	This will only be a risk until re-vegetation is successful.
	PM	
Altered storm water runoff response due to large impervious areas and concentrated runoff in drainage systems.	DC	Installation of conservative run-off and land-use plan. Create a rough surface to act as contours and prevent overgrazing and trampling due to agricultural activities. Create contours on excavation slopes. Monitoring through observations and regular inspections. Implementing final topography changes if required
	PM	
River diversions - change in overall gradient and therefore the flow rates and impact flood discharge and erosion/sedimentation patterns at the site and downstream.	DC	Restrict development outside the 100m setback line for all drainage channels
	PM	

The documentation which will be submitted as objective evidence of the state of the above risks at the time of closure is listed in Table 4. With the contents of these documents showing compliance with the closure criteria - also listed in Table 4 - it will be accepted that the mine has achieved the objective of stable, free draining post mining landform, which is compatible with the surrounding landscape.

**Table 4 Objective evidence and closure criteria for stable, free draining post mining landform, which is compatible with the surrounding landscape**

Closure objective	Document scope	Author	Success criteria (standard)
Post mining landform compatible with the surrounding landscape and achieves a land capability equal to that of pre mining conditions	Report on the monitoring results with regard to succession tempo of total cover in comparison with virgin vegetation adjacent to mining area	Independent EAP	Total cover and species composition is comparable to that of the adjacent virgin area
No negative effect on surface water flow and waste management practices do not leave/create legacies	Inspection of the post-mining surface area with the objective to identify erosion due to storm water and sheet flow	Independent EAP	Post-mining area declared stable by DMR
	Assessment of the completeness of removal of mine waste	Independent EAP	Final performance assessment report declares 100% removal of waste and equipment
Aadequate topsoil restoration or creation of natural surface topography	Monitoring results of erosion on steep slopes (20% gradient) and disturbed areas	Independent EAP	At the time of closure, soil loss has stabilised over the whole previously disturbed area

### 7.2.3 Provide optimal post-mining social opportunities

#### a) Optimised benefits for the social environment

- No positive and transparent relationships with stakeholders and not maintaining communication channels – not providing stakeholders including government authorities with relevant information as per legislative requirements.
- Not undertaking environmental management according to approved EMP and plans and no auditing of the environmental management system.
- Disturbance to sensitive environments such as land with historical or conservation value, urban areas, wetlands or rivers, high potential agricultural land, transport infrastructure, power transmission lines. Slow continuous damage to habitat e.g. wood collection are typical impacts on adjacent areas.
- Staff losing their jobs - mine closure can have devastating effects on communities that are reliant on mine-based income Job losses of secondary industries, businesses and contractors Contractual agreements with service providers surpassing mine closure date
- Closure standards not accepted and/or are changing. Mine closure being jeopardised by other land uses
- Poorly defined transition from mining to farming activities within different legislation
- Mine closure stalled due to non-compliance with South African legislation (national, provincial and local)
- Insufficient funds for complete rehabilitation



The impact of mine closure is limited and is not expected to alter the socio-economic circumstances of the study area significantly however those losing employment will experience significant impacts.

- Developments must be sustainable and recognise people as an element of the environment. Implement social and labour plan with mining right.
- Mine closure must be planned from inception through adequate social planning and infrastructure development that can be maintained by the communities after closure. Opportunities to redirect skills must be sought and alternatives to demolition of mine infrastructure that can be redeveloped must be investigated.
- Maintain positive and transparent relationships with stakeholders and maintaining communication channels. Provide stakeholders including government authorities with relevant information as per legislative requirements. Contract durations with service providers will be limited to address the risk of contractual agreements with service providers surpassing the mine closure date.
- Undertaking environmental management in accordance with the approved EMP and Closure Plan.

b) Minimal negative aesthetic impact

Terrain morphology plays a critical role in defining the visual envelope of mining developments and can either reduce or enhance visual impact. Apart from visual intrusion there is also the risk of reduced sense of place. Visual intrusion impact of mining activity on nearby roads, homesteads, settlements, tourist sites.

- Visual disturbance from the public road views – excavations or overburden dumps blocking the view. Large buildings, colour contrast of disturbed areas against adjacent veld or dust emission plumes
- Nuisance effects of air emissions (dust) no implementation and maintenance of dust monitoring programs accompanied by dust suppression activities if required.
- Accumulation of spoils from rock saws (fines) can expose highly erodible fine sediment to wind transport and lead to dust generation and dispersal. Dust can retard vegetation growth and reduce the palatability of vegetation.
- Dust generated on haul roads reduces visibility in opencast pit, representing a safety hazard.
- The cumulative effect of a raise in the ambient noise levels or high noise levels in specific areas that exceed specified levels. Noise disturbance and light pollution as a result of night activities.
- Disturbance of archaeological sites not implement mitigating measures according to the archeological assessment. Progressive development can encroach upon or disturb archaeological sites, cultural heritage sites or graves.

Although the location of quarries is primarily determined by the location of geologic deposits, being situated nearby a major highway is preferable to minimize transportation costs. This often results in quarry sites that are established close to human habitation. Blasting, cutting, and truck traffic contribute to noise, vibration, and dust problems for local residents. Further, the public may protest the unfavorable aesthetics and the safety hazards posed by stone piles and quarry holes. By following best practices, these effects on quarry neighbors and the negative perceptions held by the general public can be mitigated.

Minimal negative aesthetic impact will be achieved by the implementation of the tasks required to limit residual environmental impact listed above including the following:

- Effective use of topography, architectural design and vegetation screens can limit long distance visibility. Residue dumps can be designed to lower the profile and silhouette and reduce colour contrast and dust plumes through rehabilitation. Well-vegetated residue

stockpiles and end-use rehabilitation scenario adjacent to an urban area can reduce the perceived impact of visual intrusion.

- One of the most prominent environmental impacts of granite mining is the loss of visual integrity but these operations are not developed close to urban areas and/or main roads.
- Identify infrastructure and services to remain after closure.
- All infrastructures, temporary housing and services used during the mining period will be removed from the site.
- Waste material of any description, including receptacles, scrap, rubble and tyres, must be removed entirely from the mining area and disposed of at a recognised landfill facility. It will not be buried or burned on the site.
- All equipment and other items used during the mining operation needs to be removed from the site at final closure.
- Dust suppression must be undertaken in conjunction with a dust monitoring programme that places dust deposition gauges or receiving buckets, directional dust collection receptacles, high volume active air samplers or continuous particle monitors or even personal exposure samplers at generation sites, around the mine and in adjacent areas.
- Nuisance dust reduces environmental amenity without necessarily being harmful and comprises particles in the 50 µm to 1 mm size range and equates to the total suspended particles (TSP). Inhalable dust Particles commonly less than 10 µm size range (PM10) (80% from 2.5–10 µm size range) and inhaled into the trachea and bronchia section of the lungs. Respirable dust Dust less than 2.5 µm (PM2.5) that penetrates the lung's unciliated airways and lodges in the alveolar region.
- The best form of control is not to allow emissions to occur. From a particulate perspective this will entail preventing dust from being picked up on exposed surfaces. The only long term sustainable solution is to have a vegetation cover preventing dust pickup. This could also include a mixture with rock to roughen up the surface.
- Exposed areas such as roads can be sprayed with water. This works effectively for a while but dries out and thus needs to be continually applied to be effective. Dust binders can be sprayed on these exposed areas to give longer term protection.
- The wind velocity on the surfaces of large areas needs to be reduced to prevent dust pickup. This can be done by ploughing the area perpendicular to the prevailing wind direction using a deep plough. This is known as "ridge ploughing". Other techniques include the installation of netting or other barriers in rows perpendicular to the prevailing wind.
- Retain or replace as much native vegetation as possible throughout the quarry's operation. Root structures help maintain soil stability, while tall vegetation— particularly trees—can act as a filter for dust plumes flowing through.
- Vehicles should be washed regularly to reduce the amount of fines dispersed onto roads.
- All remaining service roads needs to be graded with provision of efficient storm water control to prevent erosion of steep slopes and roadways and elsewhere are required.
- During decommissioning and rehabilitation levels of dust generation need to be monitored and if dust levels rise above acceptable limits dust should be controlled in the interest of improved worker health and safety. In this instance periodic wetting of the maneuvering areas can be considered (No used oil or diesel is to be used for dust suppression).
- Involve all employees/contractors in the speed reduction campaign as road surface condition is more related to speed than to frequency of use.
- Prepare a noise reduction plan to cover all significant impacts at source and implement noise reduction and screening to limit exposure. Drilling and blasting is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. A hearing conservation programme must be implemented where noise exceeds 85dB (A)

in the mine or must not be more than 7dB (A) above ambient residual noise levels beyond mine boundary or nearest residential community.

- The highest magnitude noise impacts are commonly the high intensity, short duration noise levels created by blasting in surface or opencast mines. Blasting should not be carried out under very overcast conditions or low level cloud cover as this increases the noise and vibration transmission. This impact can be reduced through selection of explosives, sequencing of the blasts, deflection by structures and timing of the blast to coincide with periods of high activity or increased ambient noise levels.
- Turn off saws and machines when not in use, and consider one-way on-site traffic to lessen the use of backup sirens.
- Conduct cultural heritage resource assessment through existing databases and a site specific search in areas to be disturbed or sites of known occurrences.
- Implement mitigating measures as identified in the archaeological assessment completed for the area. Demarcate sensitive areas and control access.

Risks and risk levels associated with the objective of optimum post-mining social activities are listed in Table 5. At the time of final closure there will be no significant risks.

**Table 5 Risks, risk levels and mitigating actions in terms of optimum post-mining social opportunities**

Risk	Risk Rating	Mitigation Actions
Dust generation during demolition activities	DC	Maintenance of the existing complaints register
Noise generation during demolition activities	PM - N/A	Communication of dust, noise and increased traffic related activities to the affected community and the expected durations of these activities
Traffic during demolition activities		Continuation of current dust suppression activities
Dust from farm roads and disturbed land	DC	Continuation of current dust suppression activities
	PM	

The documentation which will be submitted as objective evidence and the closure criteria against which the contents of these documents will be measured are summarised in Table 6. Achieving these criteria will be evidence of achieving the objective of optimum post-mining social opportunities.

**Table 6 Objective evidence and closure criteria for optimum post-mining social opportunities**

Closure objective	Document scope	Author	Success criteria (standard)
Limited environmental impacts during demolition activities	Summary of all complaints received during demolition activities and follow up actions	Mine SHE Head, audited by independent EAP	Nuisance levels consistently on par with legislative standards after completion of demolition activities All incidents older than 90 days investigated and feedback given to complainant

## **8 ESTIMATED COST FOR REQUIREMENTS TO FULLY DECOMMISSION THE SITE**

With the repeal of Section 41 of the MPRDA (Act 28 of 2002) that requires that the owner of a mine must make financial provision for the remediation of environmental damage, regulations pertaining to the financial provision for prospecting, exploration, mining or production operations under section 44, read with sections 24 of the National Environmental Management Act, 1998 (Act No.107 of 1998) were issued in 2015.

According to regulation 6 an applicant must determine the financial provision through a detailed itemisation of all activities and costs, calculated based on the actual costs of implementation of the measures required for— (a) annual rehabilitation, as reflected in an annual rehabilitation plan; (b) final rehabilitation, decommissioning and closure of the prospecting, exploration, mining or production operations at the end of the life of operations, as reflected in a final rehabilitation, decommissioning and mine closure plan; and (c) remediation of latent or residual environmental impacts which may become known in the future, including the pumping and treatment of polluted or extraneous water, as reflected in an environmental risk assessment report.

According to regulation 7 the applicant or holder of a right or permit must ensure that the financial provision is, at any given time, equal to the sum of the actual costs of implementing the plans and report contemplated in regulation 6 and regulation 11(1) for a period of at least 10 years forthwith. In terms of regulation 11(1) the holder of a right or permit must ensure that a review is undertaken of the requirements for (a) annual rehabilitation, as reflected in an annual rehabilitation plan; (b) final rehabilitation, decommissioning and closure of the prospecting, exploration, mining or production operations at the end of the life of operations as reflected in a final rehabilitation, decommissioning and mine closure plan; and (c) remediation of latent or residual environmental impacts which may become known in the future, as reflected in an environmental risk assessment report.

In terms of regulation 11(2) the holder of a right or permit must, on completion of the actions contemplated in sub regulation (1), ensure that the adequacy of the financial provision is assessed and any adjustments that need to be made to the financial provision are identified within one year of the commencement of the operations authorised in the right or permit; or where the operations has commenced immediately after its financial year end that follows such commencement.

### **8.1 Assessment of financial provision**

The assessment of the financial provision requirements for annual rehabilitation in terms reg. 6(a) is provided for as part of the annual rehabilitation plan that form part of the annual environmental audit of the implementation of the environmental authorization and closure plan in terms of the NEMA EIA regulations (2014).

No remediation of latent or residual environmental impacts which may become known in the future were identified at this stage. Financial provision in terms of reg. 6(c) are covered by the requirements for the actual costs of implementation of the measures required for final rehabilitation, decommissioning and closure of the mining operations at the end of the life of operations as reflected in this final rehabilitation, decommissioning and mine closure plan in terms of reg. 6(b).

### **8.2 Calculation of Closure cost**

This calculation is not based on the standard rates provided for calculation of closure cost as the guideline are calculated using assumptions that are far removed from the mining methods or topographical characteristics of the waste (in particular that dimension stone waste is inert and offer no pollution potential, and that waste dumps located on a sound footing are stable at the natural angle of repose 37°).



Additionally the costs of a “sidehill fill” or “heaped fill” waste dumps that requires terracing and landscaping will be vastly different from a “valley fill” which only requires topsoil replacement on the top to allow for natural revegetation. Planting of vegetation and irrigation and adding fertilisers is also not an option in semi-arid areas and the specific vegetation units where trees are mostly absent.

Due to the fact that rehabilitation procedures for the different quarries have different closure elements a detailed itemized costing were done for each of the quarries that involved the identification of the specific closure elements.

For each closure element, various possible combinations of required rehabilitation work were identified and costs were calculated for each of these, based on quotations obtained from independent third party suppliers for earthmoving equipment rental and various other consumables (Table 7). Rates used are from the Contractors Plant Hire Association.

**Table 7: Rates and tariffs used for Calculation of Closure cost**

Earth Moving Equipment	Rental Rate /hour	Fuel Cost	Total Cost /hour
Front End Loader - 30 Ton	R687.00	R429.00	R1,116.00
Excavator - 45 Ton	R687.00	R429.00	R1,116.00
Excavator - 30 Ton	R392.00	R286.00	R678.00
Excavator - 20 Ton	R322.00	R234.00	R556.00
Cat 14 H Grader	R453.00	R234.00	R687.00
Articulated Dump Truck - 30 Ton	R392.00	R182.00	R574.00
Tipper Truck 6m <sup>3</sup>	R255.00	R156.00	R411.00
Tipper Truck 10m <sup>3</sup>	R309.00	R182.00	R491.00
Ferric Chloride 43% /Kg	R2.56		
Manual Labour /hour	R25.00		

Cost Factor	Closure Element	Cost calculation			
1	Demolish and remove Buildings Infrastructure including subsurface structures and banded fuel storage - Salvage useable material, break structure and dispose in waste dump	Cost/h	Service hours	Labour	Total
	Tipper Truck 10m <sup>3</sup> transport building rubble to waste rock dump	R491.00	4.00	0	R1,964.00
	Excavator - 20 Ton Demolish concrete and loading	R556.00	8.00	0	R4,448.00
	Cleanup	R25.00	8.00	4	R800.00
	<b>Total</b>				<b>R7,212.00</b>
2	Remove waste from temporary storage and scrap from salvage yard	Cost/h	Service hours	Labour	Total
	Tipper Truck 10m <sup>3</sup> transport to waste disposal site	R491.00	8.00	0	R3,928.00
	Treat petrochemical in oil separator - washbay	R0.00	R2,000.00	R0.00	R2,000.00
	Treat petrochemical in oil separator - fuel storage & apronwashbay	R0.00	R1,000.00	R0.00	R1,000.00
	Cleanup	R25.00	8.00	2	R400.00
	<b>Total</b>				<b>R7,328.00</b>
3	Final cleanup - remove all mining related waste walk through with landowner	Cost/h	Service hours	Labour	Total
	Tipper Truck 10m <sup>3</sup> transport to waste disposal site	R491.00	8.00	0	R3,928.00
	Cleanup	R25.00	8.00	2	R400.00
	<b>Total</b>				<b>R4,328.00</b>

Table 7: Rates and tariffs used for Calculation of Closure cost continue

4	<b>Loading and transport of soil</b>	<b>Load Vol m<sup>3</sup></b>	<b>Loads/h</b>	<b>m<sup>3</sup>/h</b>	<b>R/h</b>	<b>R/m<sup>3</sup></b>
	Excavator cycle	1.2	120	144	R678.00	R4.71
	ADT cycle	17	7	119	R574.00	R4.82
	<b>Total cost</b>					<b>R9.53</b>
5	<b>Shape waste dumps (Terracing)</b>	<b>h/ 1.6m<sup>3</sup></b>	<b>m<sup>3</sup>/h</b>	<b>Cost/h</b>	<b>Cost/m<sup>3</sup></b>	<b>Cost/m<sup>2</sup></b>
	FEL 30 ton	0.67	144.00	R678.00	R4.71	
	<b>2 Tier Total cost/m<sup>2</sup>@ 1.6m<sup>3</sup></b>		1.6			<b>R7.53</b>
	<b>3 Tier Total cost/m<sup>2</sup>@ 2.8m<sup>3</sup></b>		2.8			<b>R13.18</b>
6	<b>Spreading topsoil level area (dump top)</b>	<b>m<sup>3</sup>/h</b>	<b>m<sup>3</sup> Soil /m<sup>2</sup></b>	<b>R/m<sup>3</sup></b>	<b>R/m<sup>2</sup></b>	<b>R/Ha</b>
	Loading and transport of topsoil		5	R9.53	R1.91	R1,906.00
	Shaping Grader 140 K	1020		R0.67	R0.13	R1,347.06
	<b>Total cost</b>				<b>R2.04</b>	<b>R3,253.06</b>
7	<b>Spreading topsoil dump slopes</b>	<b>m<sup>3</sup>/h</b>	<b>m<sup>3</sup> Soil /m<sup>2</sup></b>	<b>R/m<sup>3</sup></b>	<b>R/m<sup>2</sup></b>	<b>R/Ha</b>
	Loading and transport of topsoil		10	R9.53	R0.95	R953.00
	Excavator 20Ton	108		R5.15	R0.51	R5,148.15
	<b>Total cost</b>				<b>R1.47</b>	<b>R6,101.15</b>
8	<b>Sloping Sides gravel pit 18°</b>	<b>m<sup>2</sup>/h</b>		<b>Cost/h</b>	<b>R/m<sup>2</sup></b>	<b>R/Ha</b>
	Excavator - 20 Ton	120		687.00	R5.73	R3,933.08
9	<b>Ripping and levelling Roads and all compacted areas</b>	<b>Speed</b>	<b>Ripper/Blade</b>	<b>h/Ha</b>	<b>R/h</b>	<b>R/Ha</b>
	Grader 140 K	8	3.5	0.36	R687.00	R245.36
	<b>Total cost/Ha</b>					<b>R245.36</b>
10	<b>Loading and transport of 0.2m soil cover</b>	<b>Load Vol m<sup>3</sup></b>	<b>Loads/h</b>	<b>m<sup>3</sup>/h</b>	<b>R/h</b>	<b>R/m<sup>3</sup></b>
	Excavator cycle	1.2	120	144	R678.00	R4.71
	ADT cycle	17	7	119	R574.00	R4.82
	<b>Total cost/m<sup>3</sup></b>					<b>R9.53</b>
	<b>Total cost/m<sup>2</sup>@0.2mcover</b>					<b>R1.91</b>
11	<b>Rockshading wastedump</b>	<b>m<sup>2</sup>/h</b>	<b>m<sup>2</sup>/kg</b>	<b>R/kg</b>	<b>R/m<sup>2</sup></b>	
	Ferric Chloride		20	R2.56	R0.13	
	Labour	30		R25.00	R0.83	
	Consuables Sprayer @R400/month				R0.07	
	<b>Total cost/m<sup>2</sup></b>				<b>R1.03</b>	

<b>12</b>	<b>Rockshading rockface</b>	<b>m<sup>2</sup>/h</b>	<b>m<sup>2</sup>/kg</b>	<b>R/kg</b>	<b>R/m<sup>2</sup></b>	
	Ferric Chloride		10	R2.56	R0.26	
	Labour	50		R25.00	R0.50	
	Consumables Sprayer @R400/month				R0.04	
	<b>Total cost/m<sup>2</sup></b>				<b>R0.80</b>	
<b>13</b>	<b>Blasting of highwalls</b>	<b>Spacing m</b>	<b>depth m</b>	<b>R/m</b>	<b>R/hole</b>	
	Drilling Cost	0.6	4	R15.00	R60.00	
	Blasting cost per hole				R129.00	
	<b>Total cost/m advance</b>			<b>R113.40</b>	<b>R189.00</b>	
<b>14</b>	<b>Moving of blocks to designated areas</b>	<b>h/&lt;300m</b>	<b>Cost/h</b>	<b>Cost/block</b>	<b>Cost/m</b>	
	FEL 30 ton	0.17	R678.00	R113.00		
	Placing of blocks safety barrier				R37.67	

### 8.3 Quantified Closure elements

The closure elements were identified captured and quantified by making use of a GIS software programme and colon aerial photography. The diagrams under section 4 show the locality and footprint of the closure element and the quantification of the closure elements are provided below per quarry.

**Cost Factor 1** - Demolish and remove Buildings/Infrastructure including subsurface structures and banded fuel storage - Salvage useable material, break structure and dispose in waste dump

Ivory & Desert Flame	No Buildings or infrastructure prospecting only
Rainbow	0.2 Ha including workshop and fuel supply
Cape Autumn	0.3 Ha including workshop and fuel supply
Ocean Blue 1	Shared with Cape Autumn
Ocean Blue 2	Rehabilitation part of annual rehabilitation plan - No buildings and infrastructure to be demolished
Black	Infrastructure and logistics available at Company HQ
Red 1	0.5 Ha including workshop
Red 2 & Red 3	0.5 Ha including workshop and fuel supply shared
Pink	0.5 Ha including workshop and fuel supply

**Cost Factor 2** - Remove waste from temporary storage and scrap from salvage yard

Ivory & Desert Flame	No Storage areas or Salvage Yard prospecting only
Rainbow	1 Salvage Yard and 1 Temporary waste storage area
Cape autumn	1 Salvage Yard and 1 Temporary waste storage area
Ocean Blue 1	Shared with Cape Autumn
Ocean Blue 2	Rehabilitation part of annual rehabilitation plan - No temporary storage and scrap in salvage yard to be removed
Black	1 Salvage Yard and 1 Temporary waste storage area at Company HQ
Red 1	1 Salvage Yard and 1 Temporary waste storage area
Red 2 & Red 3	1 Salvage Yard and 1 Temporary waste storage area shared
Pink	1 Salvage Yard and 1 Temporary waste storage area

**Cost Factor 3** - Final clean-up - remove all mining related waste final walk through

Ivory & Desert Flame	Non-invasive prospecting only
Rainbow	1.8Ha Footprint of sampling area
Cape Autumn	6.5Ha Footprint of sampling area
Ocean Blue 1	3.5Ha Footprint of sampling area
Ocean Blue 2	Rehabilitation only part of annual rehabilitation plan
Black	10Ha Footprint of sampling area and Company HQ with dispatch yard
Red 1	11Ha Footprint of mining operation including stockpile area
Red 2 & 3	15Ha Footprint of mining operation including sorting area & dressing yard
Pink	23Ha Footprint of sampling operation including stockpile area

**Cost Factor 5** - Shape waste dumps (Terracing)

Ivory & Desert Flame	Non-invasive prospecting only
Rainbow	0.15Ha – Historic Side hill Fill waste dump no shaping required natural angle of repose 37° Depending on surrounding topography and vegetation cover shaping of the toe will be required to facilitate natural revegetation



Cape autumn	0.8 Ha Historic (2 Tier) Heaped Fill waste dump terracing to be done as part of production
Ocean Blue 1	Greenfields – 0.5 Ha New Side hill Fill Waste dump planned no shaping required natural angle of repose 37°. Depending on surrounding topography and vegetation cover shaping of the toe will be required to facilitate natural revegetation
Ocean Blue 2	Rehabilitation only part of annual rehabilitation plan – Valley Fill waste dump no shaping required natural angle of repose 37°.
Black	0.11 Ha Historic Valley Fill waste dump no shaping required natural angle of repose 37°. 0.4Ha New Valley Fill waste dump planned no shaping required natural angle of repose 37°. Depending on surrounding topography and vegetation cover shaping of the toe will be required to facilitate natural revegetation
Red 1	0.3 Ha Secondary Valley Fill waste dump levelling of top required as part of annual rehabilitation plan to develop Salvage Yard. 1.26 Ha Historic Valley Fill waste dump shaping required as part of annual rehabilitation plan to upgrade Dressing Yard. 1Ha operational Valley Fill waste dump no shaping required natural angle of repose 37°. Depending on surrounding topography and vegetation cover shaping of the toe will be required at final footprint to facilitate natural revegetation
Red 2 & 3	0.4Ha New Valley Fill waste dump planned no shaping required natural angle of repose 37°. Depending on surrounding topography and vegetation cover shaping of the toe will be required to facilitate natural revegetation at final footprint
Pink	1.5Ha Historic Side hill Fill waste dump no shaping required natural angle of repose 37°. Depending on surrounding topography and vegetation cover shaping of the toe will be required to facilitate natural revegetation 0.63 New Valley Fill waste dump planned as part of working platform no shaping required natural angle of repose 37°. Depending on surrounding topography and vegetation cover shaping of the toe will be required to facilitate natural revegetation 0.5Ha Historic Heaped Fill waste dump decommissioned – shaping and rehabilitation to be done as part of annual rehabilitation plan

**Cost Factor 6 - Spreading topsoil level area (dump top)**

Ivory & Desert Flame Non-invasive prospecting only

Rainbow	0.15Ha – Historic Side hill Fill waste dump levelling ongoing as part of dumping to facilitate trafficability
Cape autumn	0.8 Ha Historic (2 Tier) Heaped Fill waste dump levelling ongoing as part of dumping to facilitate trafficability
Ocean Blue 1	Greenfields – 0.5 Ha New Side hill Fill Waste dump planned levelling ongoing as part of dumping to facilitate trafficability
Ocean Blue 2	Rehabilitation only part of annual rehabilitation plan - Soil cover partially completed

Black	0.11Ha Historic Valley Fill waste dump decommissioned and partially covered with soil - spreading of topsoil and rock shading to be done as part of annual rehabilitation plan 0.4Ha New Valley Fill waste dump planned levelling ongoing as part of dumping to facilitate trafficability
Red 1	0.3 Ha Secondary Valley Fill waste dump levelling of top required as part of annual rehabilitation plan to develop Salvage Yard. 1.26 Ha Historic Valley Fill waste dump shaping required as part of annual rehabilitation plan to upgrade Dressing Yard. 1Ha operational Valley Fill waste dump levelling ongoing as part of dumping to facilitate trafficability
Red 2 & 3	0.4Ha New Valley Fill waste dump planned levelling ongoing as part of dumping to facilitate trafficability
Pink	1.5Ha Historic Side hill Fill Waste dump ongoing as part of dumping to facilitate trafficability 0.63 New Valley Fill waste dump planned levelling and spreading of soil done as part of working platform to facilitate trafficability 0.5Ha Historic Heaped Fill waste dump decommissioned – Soil covering to be done post shaping as part of annual rehabilitation plan

#### **Cost Factor 7 - Spreading topsoil dump slopes**

Ivory & Desert Flame Non-invasive prospecting only

Rainbow	0.15Ha – Historic Side hill Fill dump no top soil on toe required only rock shading
Cape autumn	0.8 Ha Historic (2 Tier) Heaped Fill waste dump - spreading topsoil on dump slopes ongoing as part of levelling top to facilitate re-vegetation
Ocean Blue 1	Greenfields – 0.5 Ha Side hill Fill waste dump planned no topsoil on toe required only rock shading
Ocean Blue 2	Rehabilitation only no top soil or rock shading required on toe
Black	0.11Ha Historic Valley Fill waste dump decommissioned and partially covered with soil - rock shading on toe to be done as part of annual rehabilitation plan 0.4Ha New Valley Fill waste dump planned no top soiling required on toe only rock shading
Red 1	0.3 Ha Secondary Valley Fill waste dump to be develop as Salvage Yard no top soil or rock shading required on toe 1.26 Ha Historic Valley Fill waste dump to be develop as Dressing Yard no top soil or rock shading required on toe 1Ha operational Valley Fill waste dump no top soiling or rock shading required on toe
Red 2 & 3	0.4Ha New Valley Fill waste dump planned no top soiling or rock shading required on toe
Pink	1.5Ha Side hill Fill dump no top soiling required only rock shading 0.5Ha Historic Heaped Fill waste dump decommissioned – Soil covering to be done post shaping as part of annual rehabilitation plan

**Cost Factor 8 - Sloping Sides gravel pit 18°**

Ivory &amp; Desert Flame Non-invasive prospecting only

Rainbow	Side hill Fill waste dump no gravel pit to burry waste
Cape autumn	1.2 Ha excavation for burry Heaped Fill waste dump can be done as part of production
Ocean Blue 1	Side hill Fill waste dump no gravel pit to burry waste
Ocean Blue 2	Rehabilitation only no gravel pit required to burry waste
Black	Valley Fill waste dump no gravel pit to burry waste
Red 1	Valley Fill waste dump no gravel pit to burry waste
Red 2 & Red 3	Valley Fill waste dump no gravel pit to burry waste
Pink	Side hill Fill Waste dump no gravel pit to burry waste 0.5Ha Historic Heaped Fill waste dump decommissioned – Soil covering to be done post shaping as part of annual rehabilitation plan

**Cost Factor 9 - Ripping and levelling Roads and all compacted areas**

Ivory &amp; Desert Flame Non-invasive prospecting only

Rainbow	0.1Ha
Cape Autumn	0.7Ha
Ocean Blue 1	Greenfields – 0.5 Ha planned
Ocean Blue 2	Rehabilitation only 0.2Ha part of annual rehabilitation plan
Black	0.7Ha on decommissioned dressing yard
Red 1	1.2Ha
Red 2 & Red 3	Greenfields – 0.5 Ha planned
Pink	2Ha

**Cost Factor 10 - Loading and transport of 0.5m soil cover**

Ivory &amp; Desert Flame Non-invasive prospecting only

Rainbow	Side hill Fill waste dump No excavation
Cape autumn	0.3 Ha excavation 3m deep
Ocean Blue 1	Greenfields – 0.3 Ha excavation 3m deep
Ocean Blue 2	Rehabilitation only no gravel pit required to burry waste
Black	Valley fill No excavation
Red 1	Valley fill No excavation
Red 2 & Red 3	Valley fill No excavation
Pink	Side hill Fill waste dump No excavation 0.5Ha Historic Heaped Fill waste dump decommissioned – Soil covering to be done post shaping as part of annual rehabilitation plan

**Cost Factor 11 - Rockshading wastedump**

Ivory &amp; Desert Flame Non-invasive prospecting only

Rainbow	0.15Ha – Historic Side hill Fill dump only rock shading on toe
Cape autumn	0.8 Ha Historic (2 Tier) Heaped Fill waste dump - spreading topsoil no rock shading required
Ocean Blue 1	Greenfields – 0.5 Ha Side hill Fill waste dump planned only rock shading on toe
Ocean Blue 2	Rehabilitation only no rock shading required on toe
Black	0.11Ha Historic Valley Fill waste dump decommissioned and partially covered with soil - rock shading on toe to be done as part of annual rehabilitation plan 0.4Ha New Valley Fill waste dump planned only rock shading on toe

Red 1	0.3 Ha Secondary Valley Fill waste dump to be develop as Salvage Yard rock shading required on toe 1.26 Ha Historic Valley Fill waste dump to be develop as Dressing Yard no rock shading required on toe 1Ha operational Valley Fill waste dump no rock shading required on toe
Red 2 & 3	0.4Ha New Valley Fill waste dump planned no rock shading required on toe
Pink	1.5Ha Side hill Fill dump only rock shading on toe 0.5Ha Historic Heaped Fill waste dump decommissioned – no rock shading required

### **Cost Factor 12 - Rockshading rockface**

Ivory & Desert Flame Non-invasive prospecting only

Rainbow	No high wall present for rock shading will be determined as mine develop
Cape Autumn	No high wall present for rock shading will be determined as mine develop
Ocean Blue 1	Greenfields – No high wall present for rock shading will be determined as mine develop
Ocean Blue 2	Rehabilitation only – 60m ~ 2m part of annual rehabilitation plan
Black	Greenfields – 200m ~ 24m high wall present requirement for rock shading to be determined after development depending on surrounding topography and visual impact and is estimated at 1Ha for costing purposes
Red 1	300m ~ 40m high wall present requirement for rock shading to be determined after development depending on surrounding topography and visual impact and is estimated at 1Ha for costing purposes
Red 2 & 3	Greenfields – No high wall present for rock shading will be determined as mine develop
Pink	No high wall present for rock shading will be determined as mine develop

### **Cost Factor13 - Blasting of highwalls**

Ivory & Desert Flame Non-invasive prospecting only

Rainbow	No high wall present for blasting will be determined as mine develop
Cape Autumn	No high wall present for blasting will be determined as mine develop
Ocean Blue 1	Greenfields – No high wall present for blasting will be determined as mine develop
Ocean Blue 2	Rehabilitation only – No high wall present for blasting
Black	Greenfields – 60m high wall present for blasting will be determined after development depending on surrounding topography and visual impact and is estimated at 300m for costing purposes
Red 1	300m ~ 30m high wall present requirement for blasting to be determined after development depending on surrounding topography and visual impact and is estimated at 300m for costing purposes
Red 2 & Red 3	No high wall present for blasting will be determined as mine develop
Pink	No high wall present for blasting will be determined as mine develop



**Cost Factor 14 - Moving of blocks to designated areas**

Ivory &amp; Desert Flame Non-invasive prospecting only

Rainbow	30 blocks to be moved as part of annual rehabilitation plan and will then be address as part of production and housekeeping
Cape autumn	300 blocks to be moved as part of annual rehabilitation plan and will then be address as part of production and housekeeping
Ocean Blue 1	Greenfields – To be address as part of production and housekeeping
Ocean Blue 2	Rehabilitation only 20 blocks to be moved as part of annual rehabilitation plan
Black	300 blocks to be moved including dispatch yard as part of annual rehabilitation plan and will then be address as part of production and housekeeping
Red 1	2000 blocks to be moved as part of annual rehabilitation plan and will then be address as part of production and housekeeping
Red 2 & 3	Greenfields – To be address as part of production and housekeeping
Pink	1500 blocks to be moved as part of annual rehabilitation plan and will then be address as part of production and housekeeping

The following risk based criteria and assumptions were used to calculate the final rehabilitation, decommissioning and closure cost:

- Removal of all structures and infrastructure not to be retain by the landowner in terms of section 44 of the MPRDA.
- All fixed assets that can be profitably removed will be removed for salvage or resale.
- Any item that has no salvage value to the mine, but could be of value to individuals, will be sold (zero salvage assumed in cost estimation) and the remaining treated as waste and removed from site.
- All structures will be demolished and terracing and foundations removed to the lesser of 500 mm below the original ground level.
- Inert waste, which is more than 500 mm underground, such as pipes, will be left in place
- A hazardous disposal site will not be constructed and all hazardous waste will be removed from site and transported to the nearest licensed facility.
- All services related to the mining operation, water supply lines and storage on site will have to be demolished; the closure cost is therefore included in this estimate.
- Existing tracks will be used and no new roads will be developed.
- The stockpile and logistics area will not exceed the planned footprint.
- It is assumed that the post-mining pit stability and waste dump profile will be addressed as part of the operation and necessary remedial actions implemented prior to closure.
- Shaping of historic waste dumps to be used needs to be done and ad hoc waste moved to the demarcated waste dump, the closure cost is therefore included in this estimate.
- Diversion of drainage channels due to historic waste dumps or agricultural practices will not be reinstated but mitigation to prevent damming of water will be implemented as part of annual rehabilitation.

## 8.4 Total estimated cost for requirements to fully decommissioned the mining site at final closure

<b>Cost Factor 1</b>				
<b>Demolish and remove Buildings/Infrastructure including subsurface structures and banded fuel storage - Salvage useable material, break structure and dispose in waste dump</b>				
<b>Risk based criteria and assumptions with regard to rehabilitation of bulk sample sites</b>				
All structures will be demolished and terracing and foundations removed to the lesser of 500 mm below the original ground level.				
Inert waste, which is more than 500 mm underground, such as pipes, will be left in place				
All services related to the mining operation, water supply lines and storage on site will have to be demolished; the closure cost is therefore included in this estimate.				
<b>Mining/Sampling Area</b>	<b>Unit</b>	<b>No Units</b>	<b>Unit Cost</b>	<b>Cost per Element</b>
Ivory & Desert Flame	No Buildings or infrastructure planned for the next 3 years			
Rainbow Logistical facilities 0.2 Ha	Areas	1.00	R7,212.00	<b>R7,212.00</b>
Cape Autumn Logistical facilities 0.3 Ha	Areas	1.00	R7,212.00	<b>R7,212.00</b>
Ocean Blue 1	Shared with Cape Autumn			
Black	Infrastructure and logistics available at Company HQ			
Red 1 Logistical facilities 0.5 Ha	Areas	2.00	R7,212.00	<b>R14,424.00</b>
Red 2 Logistical facilities 0.5 Ha	Areas	1.00	R7,212.00	<b>R7,212.00</b>
Red 3	Shared with Red 2			
Pink Logistical facilities 0.5 Ha	Areas	2.00	R7,212.00	<b>R14,424.00</b>
<b>Sub-Total</b>				<b>R50,484.00</b>
<b>Cost Factor 2</b>				
<b>Remove waste from temporary storage and scrap from salvage yard</b>				
<b>Risk based criteria and assumptions with regard to rehabilitation of bulk sample sites</b>				
A hazardous disposal site will not be constructed and all hazardous waste will be removed from site and transported to the nearest licensed facility.				
Waste will be dispose/recycled every 3 month and there will never be more than 3 month worth of waste in the temporary storage areas				
Ivory & Desert Flame	No Storage or Salvage Yard planned for the next 3 years			
Rainbow	Areas	1.00	R7,212.00	<b>R7,212.00</b>
Cape Autumn	Areas	1.00	R7,212.00	<b>R7,212.00</b>
Ocean Blue 1	Shared with Cape Autumn			
Black including HQ	Areas	2.00	R7,212.00	<b>R14,424.00</b>
Red 1	Areas	2.00	R7,212.00	<b>R14,424.00</b>
Red 2	Areas	1.00	R7,212.00	<b>R7,212.00</b>
Red 3	Shared with Red 2			
Pink	Areas	1.00	R7,212.00	<b>R7,212.00</b>
<b>Sub-Total</b>				<b>R72,352.00</b>
<b>Cost Factor 3</b>				
<b>Final cleanup - remove all mining related waste walk through with landowner</b>				
<b>Risk based criteria and assumptions with regard to rehabilitation of bulk sample sites</b>				
Removal of all structures and infrastructure not to be retain by the landowner in terms of sec 44 of the MPRDA.				
All fixed assets that can be profitably removed will be removed for salvage or resale.				
Any item that has no salvage value to the mine, but could be of value to individuals, will be sold (zero salvage assumed in cost estimation) and the remaining treated as waste and removed from site.				
Ivory & Desert Flame	Non-invasive prospecting only			
Rainbow	Area <10 Ha	1.00	R4,328.00	<b>R4,328.00</b>
Cape Autumn	Area <10 Ha	1.00	R4,328.00	<b>R4,328.00</b>
Ocean Blue 1	Area <10 Ha	1.00	R4,328.00	<b>R4,328.00</b>
Black	Area <10 Ha	1.00	R4,328.00	<b>R4,328.00</b>
Red 1	Area <10 Ha	2.00	R4,328.00	<b>R8,656.00</b>
Red 2	Area <10 Ha	1.00	R4,328.00	<b>R4,328.00</b>
Red 3	Area <10 Ha	1.00	R4,328.00	<b>R4,328.00</b>
Pink	Area <10 Ha	2.00	R4,328.00	<b>R8,656.00</b>
<b>Sub-Total</b>				<b>R43,280.00</b>

<b>Cost Factor 5</b>				
<b>Shape waste dumps (Terracing)</b>				
<b>Risk based criteria and assumptions with regard to rehabilitation of bulk sample sites</b>				
It is assumed that the post-mining stability and waste dump profile will be addressed as part of the operation and necessary remedial actions implemented prior to closure.				
Shaping of historic wastedumps to be used needs to be done and the closure cost is therefore included in this estimate. Heaped fill dumps will be divided in <0.4Ha segments to facilitate shaping on a concurrent basis. The first tier will be buried and the second tier will be $\pm 6$ m above natural surface level Valley fill will only require shaping of the toe to assist natural revegetation taking into account the surrounding topography and vegetation cover				
The historic waste dump at the Kalahari Galaxy quarry will not be reused and no rehabilitation will be done as the area is nearly fully revegetated through natural plant succession.				
Diversion of drainage channels due to historic waste dumps or agricultural practices will not be reinstated but mitigation to prevent damming of water will be implemented as part of annual rehabilitation.				
Ivory & Desert Flame	Only non-invasive prospecting planned during the next review period			
Rainbow (Side hill Fill )	no shaping required natural angle of repose 37°			
Cape Autumn (Heaped fill dump 2 Tier)	m <sup>2</sup>	8,000.00	R7.53	<b>R60,240.00</b>
Ocean Blue 1 (Side hill Fill )	no shaping required natural angle of repose 37°			
Black (Valley Fill)	no shaping required natural angle of repose 37°			
Red 1 (Valley Fill)	no shaping required natural angle of repose 37°			
Red 2 (Valley Fill)	no shaping required natural angle of repose 37°			
Red 3 (Valley Fill)	Shared with Red 2			
Pink (Side hill Fill)	no shaping required natural angle of repose 37°			
<b>Sub-Total</b>				<b>R60,240.00</b>
<b>Cost Factor 6</b>				
<b>Spreading topsoil level area (Top of wastedump)</b>				
<b>Risk based criteria and assumptions with regard to rehabilitation of bulk sample sites</b>				
It is assumed that the post-mining stability and waste dump profile will be addressed as part of the operation and necessary remedial actions implemented prior to closure.				
Spreading of sub-soil is done as part of operations to improve traficability on the top of the wastedump. Heaped fill dumps will be developed in segments < 0.4Ha to provide for concurrent rehabilitation as part of the annual rehabilitation plan.				
Ivory & Desert Flame	Only non-invasive prospecting planned during the next review period			
Rainbow (Side hill Fill )	Ha	1.50	R3,253.06	<b>R4,879.59</b>
Cape Autumn (Heaped fill dump 2 Tier)	Ha	0.80	R3,253.06	<b>R2,602.45</b>
Ocean Blue 1 (Side hill Fill )	Ha	0.50	R3,253.06	<b>R1,626.53</b>
Black (Valley Fill)	Ha	0.40	R3,253.06	<b>R1,301.22</b>
Red 1 (Valley Fill)	Ha	1.00	R3,253.06	<b>R3,253.06</b>
Red 2 (Valley Fill)	Ha	0.40	R3,253.06	<b>R1,301.22</b>
Red 3 (Valley Fill)	Shared with Red 2			
Pink (Side hill Fill)	Ha	1.50	R3,253.06	<b>R4,879.59</b>
<b>Sub-Total</b>				<b>R19,843.67</b>
<b>Cost Factor 7</b>				
<b>Spreading topsoil dump slopes</b>				
<b>Risk based criteria and assumptions with regard to rehabilitation of bulk sample sites</b>				
It is assumed that the post-mining stability and waste dump profile will be addressed as part of the operation and necessary remedial actions implemented prior to closure.				
The sides of heaped fill dumps will be covered with topsoil but vally filled dumps will be evaluated in terms of natural topography and vegetation requirements at final footprint.				
Ivory & Desert Flame	Non-invasive prospecting only			
Rainbow (Side hill Fill )	no topsoil on toe required only rock shading			
Cape Autumn (Heaped fill dump 2 Tier)	Ha	6.40	R6,101.15	<b>R39,047.36</b>
Ocean Blue 1 (Side hill Fill )	no topsoil on toe required only rock shading			
Black (Valley Fill)	no topsoil on toe required only rock shading			
Red 1 (Valley Fill)	no top soil or rock shading required on toe			
Red 2 (Valley Fill)	no top soil or rock shading required on toe			
Red 3 (Valley Fill)	Shared with Red 2			
Pink (Side hill Fill )	no top soil or rock shading required on toe			
<b>Sub-Total</b>				<b>R39,047.36</b>

<b>Cost Factor 8</b>				
<b>Sloping Sides gravel pit 18°</b>				
<b>Risk based criteria and assumptions with regard to rehabilitation of bulk sample sites</b>				
Only heaped fill dumps will require excavations to bury the first tier and obtain sub-soil for covering surface section of waste dump				
Ivory & Desert Flame	Non-invasive prospecting only			
Rainbow (Side hill Fill )	no gravel pit to bury waste			
Cape Autumn (Heaped fill dump 2 Tier)	Ha	1.20	R3,933.08	<b>R4,719.70</b>
Ocean Blue 1 (Side hill Fill )	no gravel pit to bury waste			
Black (Valley Fill)	no gravel pit to bury waste			
Red 1 (Valley Fill)	no gravel pit to bury waste			
Red 2 (Valley Fill)	no gravel pit to bury waste			
Red 3 (Valley Fill)	no gravel pit to bury waste			
Pink (Side hill Fill )	no gravel pit to bury waste			
			<b>Sub-Total</b>	<b>R4,719.70</b>
<b>Cost Factor 9</b>				
<b>Ripping and levelling Roads and all compacted areas</b>				
<b>Risk based criteria and assumptions with regard to rehabilitation of bulk sample sites</b>				
Existing tracks will be used and no new roads will be developed.				
The stockpile and logistics area will not exceed the planned footprint.				
Ivory & Desert Flame	Non-invasive prospecting only			
Rainbow	Ha	0.10	R245.36	<b>R24.54</b>
Cape Autumn	Ha	0.70	R245.36	<b>R171.75</b>
Ocean Blue 1	Ha	0.50	R245.36	<b>R122.68</b>
Black	Ha	0.70	R245.36	<b>R171.75</b>
Red 1	Ha	1.20	R245.36	<b>R294.43</b>
Red 2	Ha	0.50	R245.36	<b>R122.68</b>
Red 3	Shared with Red 2			
Pink	Ha	2.00	R245.36	<b>R490.72</b>
			<b>Sub-Total</b>	<b>R1,575.21</b>
<b>Cost Factor 10</b>				
<b>Loading and transport of 0.5m soil cover</b>				
<b>Risk based criteria and assumptions with regard to rehabilitation of bulk sample sites</b>				
Excavations to bury waste only applicable to heapfill and area will not exceed the planned footprint.				
Ivory & Desert Flame	Non-invasive prospecting only			
Rainbow (Side hill Fill )	No excavations planned			
Cape Autumn (Heaped fill dump 2 Tier)	m³	3,000.00	R9.53	<b>R28,590.00</b>
Ocean Blue 1 (Side hill Fill )	No excavations planned			
Black (Valley Fill)	No excavations planned			
Red 1 (Valley Fill)	No excavations planned			
Red 2 (Valley Fill)	No excavations planned			
Red 3 (Valley Fill)	No excavations planned			
Pink (Side hill Fill)	No excavations planned			
			<b>Sub-Total</b>	<b>R28,590.00</b>



<b>Cost Factor 11</b>				
<b>Rockshading wastedump</b>				
<b>Risk based criteria and assumptions with regard to rehabilitation of bulk sample sites</b>				
No rock shading required on heapfill dumps				
Shading on toe of valley fill to be evaluated at final footprint taking into account surrounding topography and visual impact				
Ivory & Desert Flame	Non-invasive prospecting only			
Rainbow (Side hill Fill )	m <sup>2</sup>	1,500.00	R1.03	<b>R1,545.00</b>
Cape Autumn (Heaped fill dump 2 Tier)	no rock shading required			
Ocean Blue 1 (Side hill Fill )	m <sup>2</sup>	5,000.00	R1.03	<b>R5,150.00</b>
Black (Valley Fill)	m <sup>2</sup>	1,100.00	R1.03	<b>R1,133.00</b>
Red 1 (Valley Fill)	m <sup>2</sup>	3,000.00	R1.03	<b>R3,090.00</b>
Red 2 (Valley Fill)	m <sup>2</sup>	4,000.00	R1.03	<b>R4,120.00</b>
Red 3 (Valley Fill)	Shared with Red 2			
Pink (Side hill Fill)	m <sup>2</sup>	15,000.00	R1.03	<b>R15,450.00</b>
<b>Sub-Total</b>				<b>R30,488.00</b>
<b>Cost Factor 12</b>				
<b>Rockshading rockface</b>				
<b>Risk based criteria and assumptions with regard to rehabilitation of bulk sample sites</b>				
Shading on high wall to be evaluated at final footprint taking into account surrounding topography and visual impact				
Ivory & Desert Flame	Non-invasive prospecting only			
Rainbow	No highwall rock shading will be determined as mine develop			
Cape Autumn	No highwall rock shading will be determined as mine develop			
Ocean Blue 1	No highwall rock shading will be determined as mine develop			
Black	m <sup>2</sup>	4,800.00	R0.80	<b>R3,840.00</b>
Red 1	m <sup>2</sup>	12,000.00	R0.80	<b>R9,600.00</b>
Red 2	Greenfields – No highwall rock shading will be determined as mine develop			
Red 3	Greenfields – No highwall rock shading will be determined as mine develop			
Pink	No highwall rock shading will be determined as mine develop			
<b>Sub-Total</b>				<b>R13,440.00</b>
<b>Cost Factor 13</b>				
<b>Blasting of highwalls</b>				
<b>Risk based criteria and assumptions with regard to rehabilitation of bulk sample sites</b>				
Blasting of high wall to be evaluated at final footprint taking into account surrounding topography and pit stability				
Ivory & Desert Flame	Non-invasive prospecting only			
Rainbow	No highwall present for blasting will be determined as mine develop			
Cape Autumn	No highwall present for blasting will be determined as mine develop			
Ocean Blue 1	No highwall present for blasting will be determined as mine develop			
Black	m	200.00	R113.00	<b>R22,600.00</b>
Red 1	m	600.00	R113.00	<b>R67,800.00</b>
Red 2	No highwall present for blasting will be determined as mine develop			
Red 3	No highwall present for blasting will be determined as mine develop			
Pink	No highwall present for blasting will be determined as mine develop			
<b>Sub-Total</b>				<b>R90,400.00</b>
<b>Cost Factor 14</b>				
<b>Moving of blocks to designated areas</b>				
<b>Risk based criteria and assumptions with regard to rehabilitation of bulk sample sites</b>				
Placing of blocks in designated areas to be done as part of housekeeping in the annual rehabilitation plan.				
Removal of blocks used for demarcation and low grade product to the demarcated waste dump at final closure.				
Removal of safety barrier to be evaluated at final footprint and depth of mine pit				
Ivory & Desert Flame	Non-invasive prospecting only			
Rainbow	Blocks	30.00	R37.67	<b>R1,130.10</b>
Cape Autumn	Blocks	300.00	R37.67	<b>R11,301.00</b>
Ocean Blue 1	Greenfields – To be address as part of production and housekeeping			
Black and dispatch yard	Blocks	300.00	R37.67	<b>R11,301.00</b>
Red 1	Blocks	2,000.00	R37.67	<b>R75,340.00</b>
Red 2	Greenfields – To be address as part of production and housekeeping			
Red 3	Greenfields – To be address as part of production and housekeeping			
Pink	Blocks	1,500.00	R37.67	<b>R56,505.00</b>
<b>Sub-Total</b>				<b>R155,577.10</b>
<b>Total estimated cost to fully decommissioned the mining site at final closure</b>				<b>R610,037.03</b>

## **9 THE PUBLIC PARTICIPATION PROCESS**

### **9.1 Principles and Objectives**

The Public Participation Process (PPP) was designed to fulfil the requirements of several pieces of legislation applicable to mine closure. It forms an integral component of the mine closure process by affording Interested and Affected Parties (I&AP) the opportunity to identify environmental issues and concerns relating to the proposed closure, which they feel should be addressed. This is consistent with the provisions of the National Environmental Management Act (Act No. 107 of 1998), Section 2(4)(f), which states that "the participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured".

The objective of the prospecting operation is to develop a working PPP that informs key stakeholders', I&APs and the general public about mine closure objectives and activities during the life of the mine. The PPP was designed to provide sufficient and accessible information to I&APs in an objective manner to assist them to:

- Identify issues of concern, and provide suggestions for enhanced benefits and alternatives associated with mine closure,
- Identify risks not yet identified during the risk assessment exercise,
- Identify risks associated with mine closure and rehabilitation,
- Contribute local knowledge and experience,
- Verify that their issues have been considered.
- Comment on the Risk Assessment and Mine Closure Plan at the time of final decommissioning of the project, including the significance of potential risks that have been identified and associated impacts,
- Play an oversight role in the monitoring and evaluation of mine closure.

### **9.2 Stakeholder Identification and Project Data Base**

Existing data bases were used to inform the list of stakeholders. Special consideration was given to ensure that organizations and individuals that had expressed interest in the activities of the operation, and those who are potentially affected by mine closure, were included on the data base. The following are principles which governed the PPP:

- Key stakeholder groups and the general public comprised the target audience in the development of the PPP.
- Providing information to lay people to allow them to contribute to and participate meaningfully in the process.
- Stakeholder participation is most effective when the proponent and the practitioner recognise, acknowledge and validate stakeholder values when designing a PPP (i.e. there should be no underestimation of the technical and professional competence of citizens).
- The recognition that in the current political climate of South Africa, consultation, empowerment and capacity building is particularly important.

The process of involving stakeholders had three main objectives:

- Steps should be taken to ensure that stakeholder input into the project is relevant and representative.
- Stakeholders should be made aware of their objectives and role in the process,
- An efficient communication and feedback mechanism should be developed during the process to ensure that all stakeholders are kept informed of progress.

Stakeholders were drawn from the sectors outlined below:

- National (DWAS, DMR), Provincial (DENC, DALR) and Local Government (Local and District Municipalities)
- Industry (commercial farmers)
- Corporations and businesses (service providers to operation)
- Operations staff

The operation set up a database of I&APs using existing project databases as a starting point. Names of persons and organisations will be added to or deleted from the database where appropriate.

## **10 WAY FORWARD**

This final Rehabilitation, Decommissioning and Mine Closure Plan will be reviewed on an annual basis to align such approved financial provision set out in regulations 9 and 11, of the NEMA Financial Regulations. Concurrent rehabilitation and remediation will be provided for in the annual rehabilitation plan and will contain information that defines activities on an annual basis and how these relate to the closure vision, as detailed in this final rehabilitation, decommissioning and mine closure plan.

When final planned closure is applied for the operation will submit a final environmental performance audit report to DMR as lead agent for final perusal with the objective to issue a closure certificate. At that point, the closure process, and associated public participation program, will close.