

4. MINERAL RESOURCE AND RESERVES

4.1 Introduction

This section summarises the methods used by Kumba and Eyesizwe to derive and classify the Mineral Resource and Mineral Reserve estimates for the Material Properties. It also presents SRK's comments and opinions on the reasonableness of these estimates and presents Mineral Resource and Mineral Reserve statements as appropriate. In addition, this section sets out SRK's view regarding the potential for proving up further Mineral Resources and Mineral Reserves at the Material Properties. Detailed plans are available for inspection at various Company operating offices where they remain due to the fact that many are working plans required for the continual management of the respective operations. On request copies of specific information will be made available at Kumba Limited, Roger Dyason Road, Pretoria West, 0001, Pretoria, Gauteng Province, Republic of South Africa.

4.2 Iron Ore

4.2.1 Sishen Mine

The principal techniques used for outlining the orebody are surface mapping, geophysical surveys (gravity) and surface drilling. The surface outcrop of the entire property has been mapped, and gravity surveys have been performed at intervals over the entire mining area. Drilling is done in a phased manner, with decreasing grid spacing, or infilling, with each successive phase. Phase I to Phase IV are diamond drilled, while Phase V uses Reverse Circulation ("RC") Drilling. Phase I is drilled on a 400m grid, Phase II is on a 200m grid, Phase III is on a 100m grid, and Phase IV is on a 50m grid. Phase V RC drilling is completed in geologically or structurally complex areas to provide additional definition of the orebody and is drilled at a grid spacing of between 20m and 25m.

To date more than 13,000 exploration boreholes have been drilled, approximately 1,500,000m of drill core and percussion chips have been recovered. Annual drilling averages at between 40,000m and 50,000m and this rate has been sufficient to maintain or increase the total Mineral Resource remaining after mining. The majority of the exploration drilling is NQ (54.8mm) sized, although in areas where ground conditions are poor, typically with cavities and poorly consolidated ground, the holes may be drilled to BQ (42.1mm) size. All the exploration drill hole collar positions are surveyed with a differential GPS.

The rock chips from the RC drilling and the core from the diamond drilling are logged by a geologist, and the data stored in a drill hole management database. All visibly ferruginized core or rock chips are sampled. In addition to assaying all ferruginous material, 1m composite waste samples above and below the ore intersection are assayed. Sample lengths are variable, but the minimum sample length is 0.4m, the maximum is 3.5m, and the standard length is 3m. Samples are restricted to one material type. The core is diamond sawed in half lengthways, and one-half is crushed with a jaw crusher before being sent for assay, while the other is retained for reference. RC samples are bagged for every 0.5m of drilling and are dried and split on site. Composites of the chips are made after geological logging to create sample lengths of 3m or reflecting the material type logged, with a minimum sample length of 0.4m. A core recovery of greater than 90% is required for a sample to be taken.

On receipt of the samples at the mine laboratory sample preparation area, all samples, whether originating from percussion or diamond drilling, are then reduced to -2mm by a gyroll crusher and then split to a 0.6-1.4kg sample for analytical procedures using a rotary splitter. Pellets are then made from the pulverised samples, which are then automatically analysed for FeO total, K₂O, P₂O₅, Al₂O₃, MnO, MgO and CaO by XRF methods. Results are automatically recorded by the analytical instruments, captured electronically and sent directly to the geology department as digital data files.

Material that falls outside the traditional definition of ore, but that will be processed as part of the SEP is sampled in the same manner, and where such material has been drilled in the past, and not sampled, a programme is in place to sample all of this material for areas that could still be mined. The drilling standards have been modified for drilling in BIF to ensure that at least 25m below the ore contact is drilled to intersect sufficient material that could contribute to the SEP.

In addition to sampling of the drilling core and rock chips, during the pre-feasibility and feasibility studies, bulk samples of particular material types that could be part of the SEP were taken from stockpiles, and from in pit benches, to test the potential for upgrading the material to produce a saleable product. During the pre-feasibility study, each sample was 3kt, which was fed through a primary and then secondary crusher. An incremental sampler, sampling at set variable interval rates, covering the total sample, produces a final sample of approximately 2.5t. During the feasibility study, the samples taken were in aggregate 80t and the final sample produced was approximately 3t.

In both the pre-feasibility and the feasibility studies the final samples were dispatched to Kumba Research and Development for screening in several size fractions, and beneficiation tests performed at several density separations. The results of these tests were used to generate the beneficiation algorithms applicable to the individual SEP material types. For the drilling samples, density measurements are performed on all sample pulps utilising a density meter, which is calibrated on a daily basis. The density measurements are validated against an empirically derived Fe% versus relative density graph which gives the expected upper and lower limits of the relative density expected from the measured Fe%.

Standard samples are submitted randomly with the production geology drilling samples (Phase V), but not with the exploration drilling samples (Phases I to IV). A standard sample has been created from Sishen iron ore, and is used by the MRM Department. Differences of greater than one Standard deviation from the accepted value are flagged for re-assay. Duplicate samples are not routinely submitted; however over the past couple of years, over 200 duplicates have been submitted to the mine laboratory. A good correlation between the original and the duplicate samples has been observed for the major elements analysed. Blank samples are not submitted as the XRF machine is calibrated to analyse samples with Fe% greater than 35% and a blank sample would not give a meaningful result.

The Sishen mine laboratory is SANAS accredited (No: T0195) as from November 2002 and since 1994 has complied with ISO 9002 Standards. The Sishen laboratory participates in a round-robin programme with different laboratories of Kumba, Mittal and Assmang. The laboratory has its own programme of analysing standards and duplicates in addition to those submitted with the mine samples.

The major lithological units in and surrounding the mineralised lithologies are modelled with wireframes. Verification of the classification of the lithological codes assigned to the intervals in the drill holes is done both visually, as well as automatically by comparing the assayed value with the material type and correcting ore materials assigned as waste materials and *vice versa*. Vertical sections are drawn on regular intervals and rings representing continuous lithological or material units are created. These are linked up between the sections to create the material wireframes. These solids are verified for overlaps and include waste materials within the ore where the intersections are sufficiently continuous.

The major mining areas (North Mine, Middle Mine and South Mine) are divided up into structural domains representing areas with relatively homogenous structural, geological, or chemical characteristics. These various domains are used to create block models with a parent block size of 20m x 20m x 12.5m in X, Y and Z dimensions, respectively. The blocks are sub-celled to dimensions of 10m x 10m x 6.25m to more accurately represent the volume of the ore wireframes. Data of Fe, SiO₂, Al₂O₃ K₂O, P and Density of material types are extracted from the validated drillhole database, within each of the material type wireframes, for each ore type within each structural domain and composited to 3m composites. Zero values are removed to ensure that geostatistical evaluations are based only on analysed data.

Anisotropic variograms are calculated for each element, for each structural domain, with the shortest axis perpendicular to the plane of the orebody and tilted to take into account the average dip of the structural domain. The modelled semi-variograms are typically either single or dual structured spherical models.

Geostatistical estimations of Fe, SiO₂, Al₂O₃ K₂O, P and density ("RD") are calculated per element per material type per structural domain by means of Ordinary Kriging ("OK") for main ore, conglomeratic ore and Banded Iron Formation ("BIF"). Directional search ellipsoids are orientated in the dip plane of the specific structural domain. An initial estimation is done using a search with 1.3 times the semi-variogram range. A second estimation is then undertaken using an expanded search of 2 times the semi-variogram range to estimate any blocks that remain uninformed by the initial run. This only affects zones classed as Inferred. A minimum of three and a maximum of 50 samples are used in the estimation.

Geostatistical estimations of Fe, SiO₂, Al₂O₃ K₂O and P for the different waste materials are calculated per element per material type per structural domain by means of Inverse Distance Squared ("ID²ⁿ"). RD for the different waste materials is calculated according to the Fe grade, based on an empirically derived correlation.

Subsequent to the estimation of the block models, they are sliced up into corridors, based on the easting and separately on the northing values. The average grade of the blocks in the model within each corridor is compared to the average grade of the composite samples within the corridor, to ensure the model honours the trends in the data. If there is an observed significant deviation over a couple of successive sections, a decision may be taken to modify the grade of the block model to match that of the input data more closely.

The classification of Mineral Resources at Sishen takes cognisance of three parameters. These are the relative density of drilling data, the interpreted structural complexity, and the kriging error of the Fe estimate of each block. Initially the density of drilling is assessed. If only Phase I or II has been completed then an Inferred Category is assigned. When Phase III drilling has been completed, an Indicated category is assigned, and after Phase IV or denser drilling completed, a Measured category is applied. In areas that are

interpreted to be structurally complex, taking into account; variations in thickness, dip, and the degree of intercalation of waste zones in the mineralised material; the level of confidence is less and area is downgraded to a lower confidence category.

Kriging error associated with Fe estimates is used to assist in delineation of complex areas of increased risk. Fe variance is averaged in the Z direction to create a Fe variance map. The Fe variance is compared to the mean and standard deviation of the mining areas and the structural domains, and areas of higher variance are determined, which are considered to be higher risk areas. These areas are then, in conjunction with the structurally complex areas downgraded to a lower confidence Mineral Resource Category.

The Mineral Resource and Mineral Reserve Statement for Sishen that has been reviewed by SRK is tabulated in Table 4.1.

Mineral Resources defined by Kumba are based on an iron ore quality for Main Plant ore of at least 60%Fe and for SEP ore of at least 58.5% (beneficiated) Fe, appropriate mining and processing methods and a market for the product. Kumba has considered the likely economic potential of Main Plant and SEP Mineral Resource through the use of an “optimistic” open-pit shell (an open pit shell with higher economic criteria) beyond the open-pit shell used to define the Mineral Reserves. Only the high grade ($\geq 60\%$ Fe) Main Plant material has been defined as Mineral Resource beyond this “optimistic” open-pit shell as this is considered to have potential for underground mining.

SRK has separated the Mineral Resources and Mineral Reserves in terms of three categories (op1, op2 and op3) to reflect the process used by Kumba:

- op1 represents the material within the Final Pit shell (optimised);
- op2 represents the material between the final (optimised) pit shell and the the optimistic pit shell (with higher economic assumptions);
- op3 represents the material outside the optimistic pit shell, but above 60%Fe that has potential for underground mining.

The TEPs presented as part of this CPR reflect some 1,148Mt of material as total headfeed to the Main Plant and the SEP plant. There is a difference of 115Mt between the total headfeed and the Mineral Reserves as defined by Kumba. This material is strictly additional to even the Mineral Resources that have been defined although for consistency in reporting SRK has defined this as being from Inferred Resources in the LoM Plan. The average grade of the Mineral Resource is 58.6%Fe. SRK has undertaken certain checks and calculations of the Mineral Resources and Mineral Reserves and the appropriateness of the modifying factors as well as certain economic checks and confirms the statement contained in Table 4.1.

4.2.2 Sishen South Project

The primary exploration for Iron ore at Sishen South took place in the 1950s when Iscor undertook regional gravity and magnetic geophysical surveys in the Northern Cape. Anomalies were followed up and drilled with percussion drilling techniques. In the 1990s detailed gravity surveys around Sishen south proved highly successful and individual deposits were outlined to be followed up with drilling. Surface mapping was completed in all areas where there is outcrop and the ore is not covered by calcrete.

The initial drilling done on Sishen South was all percussion drilling, but has later been replaced with diamond drilling. Currently holes are drilled with percussion drilling until just short of where the ore is expected, or to where the ground becomes competent enough, and from there the hole is completed with core drilling. The anomalies are usually initially drilled on a 100m spaced grid and off-grid holes are drilled to more closely define the margins of the orebodies. Portions of some of the deposits are currently drilled on a more widely spaced grid. Secondary infill drilling decreases the grid spacing to approximately 75m to 72m. Where geologically and structurally complicated areas are encountered a closer spaced drilling grid will be implemented. Drillhole collar positions are surveyed. A random selection of drillholes were downhole surveyed and the results all showed the holes to be within 2° of vertical. All holes are thus assumed to be vertical.

For the percussion drilling, 0.5m samples are collected, mixed and logged, and where mineralised, a 1m composite sample is taken. The RC chips and fine material are collected over 0.5m intervals and the hole is flushed after each 0.5m drilled. The RC holes are 165.1mm in diameter. The fines and chips are mixed by hand at the core shed and riffle split into two samples. A portion of each sample is then logged on a palmtop computer, and where mineralised, one of the samples is sent to the Sishen Laboratory for assay. The Sishen mine laboratory is SANAS accredited (No: T0195) as from November 2002, and since 1994 has complied with ISO 9002 Standards. The Sishen laboratory participates in a round-robin programme with different laboratories of Kumba, Ispat – Iscor and Assmang. The laboratory has its own programme of analysing standards and duplicates in addition to those submitted with the mine samples.

The electronic log is then transferred to the Sable Database where it is verified. Final depths of drilling are checked for the RC holes and verified when the core drilling begins. RC boreholes account for <5% of the total number of boreholes drilled.

The core drilling is predominantly NQ (54.8mm) and BQ (42.1mm) sized. Core is first verified in terms of depth and recovery, and then logged on a palmtop computer. The log is transferred to a Sable database and a paper copy of the log is made and verified. Recoveries are recorded on the log sheets and are typically greater than 95%. Samples are marked out in 1m lengths ensuring samples do not cross lithological boundaries and a 1m sample of waste is taken adjacent to the ore lithologies. The core is photographed before being split with a diamond saw and one-half bagged for analysis.

On receipt of the samples at Sishen laboratory sample preparation area, all samples, whether originating from percussion or diamond drilling, are then reduced to -2mm by a gyroll crusher and then split to a 0.6 – 1.4kg sample for analytical procedures using a rotary splitter. If the sample list indicates a field duplicate then a second sample is also taken, for submission to the laboratory. The sample numbers are allocated to Sishen South by the Laboratory, but assigned to samples by the Field geologist and the control samples are therefore blind to the laboratory. Field duplicates are submitted for every ten samples and a control sample made up from a 150kg sample of homogenised Sishen ore is included with every batch of 50 samples sent from the exploration site. Pellets are then made from the pulverised samples, which are then automatically analysed for FeO total, K₂O, P₂O₅, Al₂O₃, MnO, MgO, TiO₂, Ba, S, Sr, Na₂O and CaO by XRF methods. Results are automatically recorded by the analytical instruments, captured electronically and sent to the Geologists as digital data files.

The density of every sample pulp is measured with a MINDENS density meter, which is calibrated on a daily basis. A bulk density determination programme has also been undertaken, which determined an average density for each orebody.

Geological and assay drillhole data are extracted from the drillhole database and transferred to geological modelling software. Vertical east west sections are created every 50m and detailed interpretations of the geology made on these. These are checked on north south sections before being signed-off. The interpretation includes waste lithologies where they are of significant thickness, and consistent across drillholes. These interpretations are transferred to a second geological modelling package to conform to Sishen standards, where certain of the lithologies are combined to create a simplified 3D wireframe model for each lithology in each orebody. Wireframe solid shells are created by linking up the interpretation on each section.

The drillhole assays were composited to 1m for the estimation process, and omni-directional horizontal semi-variograms calculated from this data for the following elements Fe: SiO₂, Al₂O₃, K₂O, P, S and for RD, as well as shorter range vertical semi-variograms. A block model was created for each orebody, with block dimensions of 10m x 10m x 5m in the X, Y and Z direction, respectively. The wireframe solids were used to assign a percentage of the block within ore, where the whole block is not contained within the wireframe. Grades and relative densities are calculated as a length weighted average of all the intersections within a lithology type, and assigned to the waste blocks within the model. The 1m composites are used to populate the ore lithologies using ordinary kriging. Where there was sufficient data, only the diamond drill core composites were used in the estimation, however, where the data was more widely spaced, the percussion composites were used as well. Blocks that remained uninformed by the Kriging estimation were populated by using the estimated blocks and assigning a value based on the nearest neighbour. The relative density values were Kriged for the Kapstevl – Welgevonden model, but were calculated using an algorithm based on the Fe value for the remaining models. The Resource model estimates have been reviewed by various external consultants, including SRK and Snowden, for the purpose of validation and have been accepted by them.

Ore lithologies are considered for inclusion in the Mineral Resource and only material within those lithologies that has a Fe content of greater than 60% are included. The classification of the Mineral Resources is based on a combination of the density of the drilling and the Geologist's interpretation of the complexity of the geological structures in the area. The category may be downgraded if the Geologist considers the area more geologically complex. Structurally complicated areas are judged by changes in dip, faulting, folding and erratic waste intersections within the orebody. Areas with a drill grid spacing of greater than 200m will be categorised as Inferred Resources. Areas with a drill grid spacing of closer than 200m but more than 70m would be classified as Indicated Resources. Areas with a closer Drill grid spacing are considered as Measured Mineral Resources.

For purposes of valuation, the Sishen South Project has been divided into two phases:

- Phase I consists of Reserves within the LoM Plan and which have been valued on a DCF basis; and
- Phase II consists of Resources that lie outside the LoM Plan and which have been valued as exploration assets.

The Mineral Resource and Mineral Reserve Statement for Sishen South that has been reviewed by SRK is contained in Table 4.2.

4.2.3 Thabazimbi Mine

Mineral Resource estimates at Thabazimbi Mine are based predominantly on percussion drill hole sample information. A few diamond drill holes have been developed for the purposes of acquiring geological, geotechnical and geometallurgical data. Reverse circulation drilling is used only where the geological understanding of the orebody is low and where low-grade or waste zones within orebodies are being examined. Geologists at Thabazimbi Mine recognise the potential for down-hole contamination particularly in deeper drill holes. Accordingly, when lithological interpretations are made, using deep drill holes, there is a tendency to make these interpretations in a conservative fashion. All drill hole data are stored in a single database.

The percussion drill holes are sampled using a one-metre downhole interval. These samples, consisting of drill cuttings are logged by geologists, with particular reference to lithology, extent of weathering, rock colour and if possible any structural information that might be accessible from the sampling. Cuttings collected from the drill head are bagged and transported to the geological core shed facility for splitting; a small sub-sample of the cuttings is taken at the drill head for immediate lithological identification.

At the core shed, the samples are split using a riffle splitter into three samples: one sample is retained as an analytical sample, one is retained as a reference and the remaining sample is used to facilitate the logging. This sample is washed to remove dust and allow the lithologies of the retained fragments to be examined in detail and logged. Samples are bagged and labelled for assay at the mine laboratory, situated in the main process plant.

Blast holes (250mm diameter) are also sampled to assist in short-range grade control procedures. Technical staff of the mine are responsible for the sampling of all blast holes. The sample lithology is considered more important in this particular case than the sample grade. Blast hole samples are composited by lithology and single samples of each lithological unit encountered within each blast hole are prepared. One aspect of this sampling technique that must receive comment is the relative sample size and the sub-sample dimensions. Blast hole samples yield large volumes of cuttings per metre drilled and comparatively small sub-samples are retained. The granulometry of the blast holes is also fairly coarse. There has not been any application of modern sampling theory to the determination of the sampling characteristics of these ores and SRK consider that the blast hole samples are likely to retain an unacceptably large sampling variance, largely as a result of the reduction of sample volumes. However, this situation is not problematic because grade control samples do not contribute to any Mineral Resource estimation process. Drill hole collars (both blast hole and percussion drill holes) are surveyed by qualified surveyors; percussion holes deeper than 60m depth are surveyed using down hole instrumentation to determine the drill trace.

Percussion drill hole samples are analysed at the mine laboratory. Labelled sample bags are delivered to the mine laboratory entrance. The bags are examined to ensure that the appropriate sample numbers are present. At present, the geological department does not submit any external quality control samples to the laboratory. All laboratory quality control is the responsibility of the laboratory manager.

On receipt of the bagged samples, the bags are inspected and if the samples are dry, approximately 50g of sample are scooped from the bag and milled. If the sample granulometry is considered to be too coarse, the sample may be crushed within an Osborne Crusher before being milled. The large samples received by the assay laboratory are not reduced to sub-samples through any mechanical process of sample reduction. The sub-sample that is manually extracted from the bag, via scooping, is mixed with a borax binding agent and milled within a closed circuit ring and puck mill and approximately 8g of the resultant pulp is extracted and compressed into a pressed pellet using a hydraulic press; the pellet is approximately 25mm in diameter. These pellets are then analysed using XRF to determine Fe total, SiO₂, Al₂O₃, MnO, P₂O₅, CaO, MgO, K₂O and TiO₂. In the past there have been some restricted programmes involving duplicated samples riffled in the geological core shed, but these have been of very short duration. At the time of writing, there is no active duplicate sample submission process and there has been no conclusive demonstration that the sampling protocols that are employed at Thabazimbi Mine do not result in high sampling variances. All analytical quality control is internal to the laboratory. Instrumental calibration is tested using reference materials that include carbon-steel samples and internal quality control materials. Mine production samples are used as internal quality controls and borate-fusion discs are prepared from sample material and circulated between Kumba Laboratories at Sishen Iron Ore Mine, Newcastle Steel Works and Saldanha Steel in an internal round-robin process. In addition, there have been tests run comparing fusion discs and pressed pellets.

Density of routine geological sample materials is not measured at the Thabazimbi Mine Laboratories. Within the sample database, the stored value for the density is estimated using a relationship that links density to the iron content. This relationship has been determined from extensive sampling conducted at Sishen Mine,

using diamond cores. This relationship has not, however been validated with respect to the Thabazimbi Mine ores and the tonnages applied within the Mineral Resource estimation purposes are based exclusively on average density values applied to individual rock types. In the case of Thabazimbi Mine, ore material is assigned a density of 4.7t.m^{-3} . Low grade ore (ore with iron content between 55% and 60%) has an assigned density of 4.1t.m^{-3} .

Analytical results from the XRF determinations are compared against the visually determined lithology of the sample. If there is an obvious mis-match between the sample geochemistry and the lithology, the sample is resubmitted for analysis. In addition, the sum of the oxides determined by XRF is estimated. In general the sum of oxides is less than 100%, implying that other elements not determined by the XRF are present within the materials. Analytical data derived from the laboratory are provided in electronic format to the geological department.

The geological and geochemical data relevant to sampled drillhole intervals are stored within a specialised geological database that has several in-built data validation procedures that trap specific errors within the drill hole data. Data are stored within this database and exported to the generalised mining software package that is used for the geological modelling. Within this software package, a data validation script is available that tests each sample interval to check that the geochemistry and the lithology are consistent; instances where these are not, are flagged and are manually checked by the relevant pit geologist responsible for the specific area of the mine.

SRK note that there are no independent analytical quality control checks that permit the geologists responsible for the Mineral Resource estimation to certify that the analytical data are of sufficient quality on which to base the Mineral Resource estimate. Furthermore the geologists are unable to declare that the analytical data are unbiased and that this characteristic is then shared by the Mineral Resource estimates. Thabazimbi Mine has had an extensive production history and the analysis of the production samples against which payments are made are undertaken at the same laboratory. In addition, the round-robin analyses conducted between the Kumba Laboratories on borate fusion discs of production samples are considered to provide a minimum level of quality control that implies that the standard geological samples are probably acceptable for use within the Mineral Resource estimation process. The use of a single density value cannot be considered to be an example of best practice, particularly when the laboratory does not routinely determine sample densities from either the few diamond drill holes that may be present or from routinely collected pit samples representative of intact specimens of ores.

Geological interpretation is undertaken on individual section planes drawn through drill holes. These section planes are digitised and captured within the generalised mining software employed for the geological modelling. In addition to the sectional interpretations, pit sidewall mapping is undertaken on suitable exposures using an MDL laser distomat instrument that records the three-dimensional co-ordinates of sample locations for geologically significant features. Location data for geological contacts mapped on any particular mine face can thus be included within the modelling process.

Wireframe modelling is undertaken on sections, delineating geological entities identified within the drill holes. The individual three-dimensional rings, developed within serial sections are linked together to form a single closed-form wireframe describing the interpreted shapes of the geological features that are being modelled. The features that are modelled include diabase dykes, the high-grade ore zones (+60% Fe) and the low-grade ore zones (ore with iron content between 55% and 60%). Prior to the modelling of the ore body lenses, data coding is undertaken. All one-metre long samples that include a contact between adjacent rock types are coded specifically. These 'mixed' samples are specifically excluded from all subsequent estimation since they are contaminated entities that do not belong to any specific lithological population. Block models with block sizes of 10m x 10m x 10m are developed for the purposes of grade interpolation. Originally, this block size was used in order to achieve a reasonable volumetric approximation to the wireframe forms used in the modelling of the orebodies.

Several years ago, Thabazimbi Mine implemented a new generalised mining software package for the purpose of orebody modelling; this programme had several significant advantages over the programme that it replaced, including the ability to sub-block against geological boundaries in order to better reproduce the ore volumes within the sub-blocked models. However, at the time of the change, Thabazimbi Mine did not re-examine the block size issue and retained the use of this block geometry. In reality, the 10m x 10m x 10m block size is significantly smaller than the typical drilling grid, which in well informed areas may approach 50m x 50m. The impact of estimating to small blocks has been the subject of several geostatistical studies and there is no doubt that small block estimates will be accompanied by biased grade-tonnage curves. Thabazimbi Mine do not report the ore estimates at cut-offs above those used to define the orebody envelopes and any attempt to do so would be erroneous; Thabazimbi Mine additionally do not base mining decisions on the grade estimates of individual blocks, but do consider qualities of aggregates of blocks.

Thabazimbi Mine make use of ordinary kriging and inverse distance squared interpolation methods for the development of the grade models used for pit planning, optimisation and the reporting of Mineral Resources. The grades of Fe, Al₂O₃, MnO, P₂O₅ and K₂O are interpolated using ordinary kriging for the ore (Fe>60%) and the low-grade ore (55%<Fe<60%); Mineral Resources are only reported from these two material types. Qualities for all other lithologies are interpolated using inverse distance squared weighting. Within the ore and low-grade ore SiO₂ is estimated using an orthogonal regression residual approach, with the regression between SiO₂ and Fe utilised for this purpose.

This estimation approach considers the interpolation of the regression residual between SiO₂ and Fe and the development of the SiO₂ estimate from the Fe estimate, the regression equation between SiO₂ and Fe (SiO₂ = m.Fe + c) and the estimated residual. This approach is advantageous as it approximates a co-kriged estimate between SiO₂ and Fe, which enjoy a strong negative correlation within the ore and low-grade ore units; use of co-kriging ensures that the relationships between the estimated Fe and SiO₂ values are coherent.

Variograms for the kriging estimates are developed from a combined data set of low-grade ore and ore samples. These variograms are updated on an annual basis. The kriged estimates are developed using a nested three-part search strategy. The first search is characterised by the shortest search distances and the requirements for the greatest number of samples, ensuring that this is the highest quality estimate that is made. Sequentially, the search ranges increase and the minimum number of data required to complete an estimate reduce, permitting more blocks that are remote from the data, yet within the interpreted wireframes to be estimated. Blocks are flagged with the index of the search volume that was used to undertake the block estimate.

Thabazimbi Mine classify the Mineral Resources using definitions of the SAMREC Code. In determining the appropriate classification Geologists at Thabazimbi Mine consider the following factors relevant to the estimates:

- Distance separating the block centroid from the nearest sample used in the estimate;
- Total number of sample data used to develop the estimate;
- The Kriging Relative Standard Deviation; and
- Search volume used to derive the estimate.

These parameters have all been used to assist in determining the classification that is to be applied to a block estimate. Indicator variograms have been developed for IFe>55%, to assist in determining the “continuity” of low-grade and ore at each of the orebodies; these variographic parameters have been used to define ‘classes’ for each orebody that express the typical continuity of high grade lenses, in this manner appropriate values for the distance to the nearest sample can be derived for each block estimate. The total number of samples used in an estimate is reflective of the total confidence in the quality of the estimate. However if the ore occurs as thin lenses, then less local samples of ore are likely to be available to service an estimate. Accordingly the confidence attached to thin lenses must be lower than that attached to thicker, more robust ore bodies. Blackwell and Sinclair (1996) proposed the use of the kriging relative standard deviation as an aid to the classification of Mineral Resources, its use here is an attempt to include variographic characteristics into the classification and use them in a manner that does not purely consider variogram range versus sample-block separations. The nested search volumes used to estimate the block grades provide an additional perspective on the data density with respect to the search requirements. At Thabazimbi Mine, the classification has been automated, by defining a set of criteria values for each of the four factors considered in the classification. Values for the factors are determined and compared against a set of critical values that define the classification system.

SRK appreciate the desirability of having a classification system that can be automated. The advantages of such a system lie primarily in the reproducibility of the classification independent of personal sentiment that the Competent Person may harbour at the time of classification. In SRK’s opinion the classification system applied at Thabazimbi Mine covers the most salient features that would be required and when the results are examined, these certainly appear reasonable when the sample density distribution is examined as well. One minor observation, for example, is that in the case of the Buffelshoek West estimate, areas of Inferred Mineral Resources occur within largely Measured Mineral Resources. This scenario is unusual in the sense that it implies that within a large area that has been classified as being very well understood, are areas in which the mine staff are unsure that ore may even be present. This type of scenario implies that there may be some requirements to either modify the criteria applied in the classification of the Mineral Resources or to manually modify the classified Mineral Resources, in order to render the classified results more coherent with adjacent blocks. These features aside, the classification system considers a wide spectrum of the most relevant features that deserve consideration in a balanced classification system.

The estimates are based on ordinary kriged estimates of small blocks. In one sense it would be preferable to make use of larger blocks that are more appropriately sized with respect to the drill hole grid spacings. If this were the case, the individual qualities of the block estimates would improve and issues such as conditional bias would be reduced. In mitigation of these effects, these estimates are developed within envelopes that are relatively restrictive with respect to the grade ranges that can physically exist, at least as far as the estimates of iron are concerned. The real issue of concern with respect to the quality of the estimates centres on some of the deleterious elements, in particular Phosphorous that frequently does not respond significantly to beneficiation, unlike Al_2O_3 and K_2O , which frequently reflect shale components within the iron ore and which often respond very favourably under beneficiation. It is highly desirable to maximise the quality of the estimates of some of these components; SRK note that the variograms of these elements have also been developed from the raw data. In SRK's experience, analysis of components like phosphorous frequently benefit from transformation of the data to a more tractable distribution compared to the usual highly-skewed distribution displayed by these elements.

Mineral Resources defined by Kumba are based on an iron ore quality of at least 55%Fe, appropriate mining and processing methods and a market for the product. SRK understands that Kumba are investigating the application of appropriate economic factors as outlined in the SAMREC Code for the definition of Mineral Resources. The application of economic factors may impact on the quantity of resources. In consideration of the work that is being undertaken and the likely increase in Kumba's iron ore resources from the Phoenix Project SRK has not modified the Mineral Resources stated above.

The Mineral Reserve Statement includes the in-situ material from the Measured and Indicated Mineral Resource categories that has been converted to produce Mineral Reserves. The Mineral Reserves have been developed following an appropriate open pit optimisation and mine design exercise and reflect the material contained within the envelope of the final open pit outline. SRK has differentiated the Mineral Resources in terms of the categories of op1 and op2 to illustrate the likely Mineral Resource converted to Mineral Reserve and remaining Mineral Resource. The converted Mineral Resource is subjected to certain mining loss and dilution modifying factors. The remaining Mineral Resource (op2) principally reflects material that is available beyond the currently accepted final open pit envelope. The TEPs presented as part of this CPR reflect the Mineral Reserves of some 13Mt. There is no material derived from other sources such as modified Inferred Mineral Resource included in the LoM Plan.

Quality Assurance and Quality Control procedures are in SRK's opinion inadequate. Notwithstanding these comments, SRK believes that the Resource and Reserve statements are SAMREC compliant. This is supported by:

- The fact that the laboratory makes use of Quality Assurance and Quality Control procedures in the determination of the final product. It must be noted that the Quality Assurance and Quality Control procedures do have an influence on the Reserve Estimations and the conversion of Resources to Reserves. In addition, sample material is circulated between Kumba Laboratories at Sishen Iron Ore Mine, Newcastle Steel Works and Saldanha Steel in an internal round-robin process.
- Historical mining and reconciliation since 1932, representing 73 years of operation.

The Mineral Resource and Mineral Reserve Statement for Thabazimbi Mine that has been reviewed by SRK is tabulated in Table 4.3.

4.2.4 Mineral Resources Estimate

Details of mineral resources estimates are contained in Table 4.4.

Table 4.1 Sishen Mine: Mineral Resource and Reserve Statement (1 January 2006)

		Mineral Resource Category ^{(1), (2), (3), (4), (6)}											
		Tonnage (Mt)	Fe (%)	SiO ₂ (%)	Al ₂ O ₃ (%)	K ₂ O (%)	P (%)	Tonnage (Mt)	Fe (%)	SiO ₂ (%)	Al ₂ O ₃ (%)	K ₂ O (%)	P (%)
Proved								Measured					
- op1	727	59.04	9.99	2.80	0.42	0.07	- op1	1,035	58.99	9.99	2.80	0.42	0.07
							- op2	443	53.75	17.84	2.35	0.35	0.07
							- op3	94	64.93	3.76	1.62	0.20	0.07
Probable							Sub-total	1,571	57.87	11.83	2.60	0.39	0.07
- op1	294	59.04	11.87	3.00	0.42	0.07							
Total⁽⁷⁾	1,021	59.04	10.53	2.86	0.42	0.07	Indicated						
							- op1	192	57.43	11.87	3.00	0.47	0.06
							- op2	287	55.88	14.26	2.61	0.31	0.07
							- op3	223	64.72	3.78	1.75	0.19	0.07
							Sub-total	702	59.11	10.28	2.44	0.32	0.07
							Inferred						
							- op1	18	56.43	11.28	2.72	0.38	0.05
							- op2	11	55.01	14.97	2.85	0.40	0.06
							- op3	153	64.50	4.01	1.82	0.21	0.07
							Sub-total	181	63.14	5.38	1.97	0.24	0.07
							Total Resources	2,455	58.61	10.51	2.36	0.34	0.06

(1) op1 represents the material within the Final Pit shell (Optimised).

(2) op2 represents the material between the final (optimised) pit shell and the optimistic pit shell (With higher economic assumptions).

(3) op3 represents the material outside the optimistic pit shell, but above 60% that has potential for underground mining.

(4) Fe >= 60% for Main Plant and Fe >= 55% for SEP.

(5) Mineral Resources stated as inclusive of Mineral Reserves.

(6) Sishen Iron Ore has a 100% equity stake in Sishen Mine, but a 78.6% undivided share in the Sishen Mine minerals rights. The remaining minerals rights are held by Mittal Steel, which is entitled to 6.25Mtpa of final ore products.

(7) The SRK FM for Scenario II includes: Inferred Resources in the LoM Plan of 17.5Mt from the Sishen Mine Reserve Scorecard File; Selective Mining of 51.2Mt from the SRK Audited Sishen Mine LoM Plan; and Various surface stockpiles (SEP 44.4Mt, MP14, 5Mt). The Inferred Resources reported have had modifying factors applied to them, such as mining losses and dilution, such that they represent headfeed tonnages and grades.

Table 4.2 Sishen South Project: Mineral Resource and Reserve Statement (1 January 2006)

Mineral Reserve Category ⁽¹⁾		Mineral Resource Category ^{(1), (2), (3), (4)}											
	Tonnage (Mt)	Fe (%)	SiO ₂ (%)	Al ₂ O ₃ (%)	K ₂ O (%)	P (%)		Tonnage (Mt)	Fe (%)	SiO ₂ (%)	Al ₂ O ₃ (%)	K ₂ O (%)	P (%)
Proved							Measured						
- op1	54	64.80	3.24	0.05	0.10	0.03	- op1	58	65.40	3.24	0.05	0.10	0.03
							- op2	31	65.40	3.24	0.05	0.10	0.03
Probable							- op3	51	65.40	3.24	0.05	0.10	0.03
- op1	11	63.30	3.97	0.05	0.20	0.02	Sub-total	140	65.40	3.24	0.05	0.10	0.03
Total	65	64.55	3.36	0.05	0.12	0.03	Indicated						
							- op1	14	64.40	3.97	0.05	0.20	0.02
							- op2	94	64.40	3.97	0.05	0.20	0.02
							Sub-total	108	64.40	3.97	0.05	0.20	0.02
							Sub-total	248	64.97	3.55	0.05	0.15	0.02
							Inferred						
							- op3	42	62.00	3.10	0.05	0.19	0.03
							Sub-total	42	62.00	3.10	0.05	0.19	0.03
							Total Resources	290	64.53	3.49	0.05	0.15	0.02

(1) op1 reflects Mineral Resources used for the definition of Sishen South Phase I.

(2) op2 reflects Mineral Resources used for the definition of the increment between Sishen South Phase I and Phase II.

(3) op3 reflects resources not associated with Sishen South Phase I and Phase II.

(4) Fe >= 60%.

(5) Mineral Resources stated as inclusive of Mineral Reserves.

Table 4.3 Thabazimbi Mine: Mineral Resource and Reserve Statement (1 January 2006)

Mineral Reserve Category ^{(1), (3)}		Mineral Resource Category ^{(1), (2), (4)}						
	Tonnage (Mt)	Fe (%)	K ₂ O (%)	P (%)	Tonnage (Mt)	Fe (%)	K ₂ O (%)	P (%)
Proved					Measured			
- op1	10	64.1	0.15	0.08	- op1	11	62.1	0.15
					- op2	12	62.1	0.15
Probable					Sub-total	23	62.1	0.15
- op1	4	63.6	0.09	0.04				
Total	14	64.0	0.13	0.07	Indicated			
					- op1	4	61.6	0.12
					- op2	14	61.3	0.12
					Sub-total	18	61.4	0.12
					Sub-total	42	61.8	0.13
					Inferred			
					- op1	3	61.7	0.11
					- op2	17	60.0	0.11
					Sub-total	20	60.3	0.11
					Total Resources	61	61.3	0.13

(1) op1 represents the material within the Final Pit shell (Optimised).

(2) op2 represents additional material outside pit limits (with higher economic assumptions).

(3) Fe >= 60%.

(4) Fe >= 55%.

(5) Mineral Resources stated as inclusive of Mineral Reserves.

Table 4.4 Iron Ore Mineral Resource Estimate (1 January 2006)

Mineral Resource Category	Tonnage (Mt)	Fe Grade (%)
Measured		
Sub-total	0.56	60.0%
Indicated	0.56	60.0%
Sub-total	447.00	34.9%
Total	447.56	34.8%
Inferred		
Total	447.56	34.8%

4.3 Coal

4.3.1 Grootegeluk Mine

The Coal Resource estimation at Grootegeluk Mine is based primarily on some 639 boreholes that cover both the mining area and the prospecting permit area. Exploration boreholes are laid out on a 500m x 500m basic grid pattern for the areas external to the approved pit layout and in filled to 250m x 250m within the approved pit layout. The cored hole is drilled to base of zone 1 + 2.5m with a large diameter core bit. The core is then logged to a 1cm resolution where required. The profile log is then compared with surrounding boreholes to ensure that correct correlation takes place and the profile is marked with the expected sample positions.

At this stage any missing section due to faulting is noted and the partial samples are not sampled to preserve the borehole database integrity. The sampling of the hole is preceded with a visual check of the borehole core with the profile and any discrepancies corrected. The coal (to cm resolution) in each sample is incorporated in a single sample suffixed "C" and the shale in a separate sample suffixed "S". The splitting of the individual samples into coal and shale is done to alleviate high costs of analysis. The individual samples are weighed in both water and air to determine an air dried raw relative density of each sample. This information is used to recombine the sample results after analysis. All the samples are submitted to ACT Coal Laboratories, which adheres to all relevant standards and procedures and is currently in the process of being accredited with SANAS, for analysis where a very prescribed analysis route is followed by the coal and shale samples. All the borehole data (lithology, zone and sample) are captured on the mine and an electronic transfer of the analytical data is obtained from the laboratory and stored in a SABLE borehole database. The analytical data is checked and validated according to a strict set graphical comparison criteria with exceptions noted and further work undertaken.

The recombining of the individual samples is performed in the SABLE database as is all the compositing of individual samples to benches. Generally the data is in a very good state. Evaluation of the modeling procedures used in the HORIZON module of the geological modeling software MINEX, indicates a very high degree of responsibility. The correlation of benches is undertaken with a very good understanding of the deposit, sections are drawn through all sectors of the deposit and checking of the bench definitions well done. In addition the sections show that the logging of the borehole information is of a very high standard.

The statistical evaluation of the coal quality information supplied indicates good database integrity. The understanding of the statistical effects of different borehole core diameters on the interpolation technique as indicated in the resource report The process being followed to build the model is an acceptable method and the results of the post-modeling sectioning indicates that the procedure is building a coherent and reliable model of the geology that is being encountered in the mine.

The creation of grids for both the structural and quality data using the growth algorithm in HORIZON for all the relevant benches results in an exceptionally large model by industry standards. The gridding of all the washability data results in thousands of grids that are used to determine blast block configuration and theoretical yields at the beneficiation plants.

The complexity of the model has resulted in the rebuilding of the model only every two years. Considering the complexity of the processing and the amount of work required to build the model this is considered to be sufficient.

The use of the geological model to determine the bench configuration has been in place at the mine since 1987, where benches are determined on lithological horizons rather than artificial elevations. The pre-mining bench determination is based on the characteristics of the coal in the ground and can be summarised as follows:

- Semi-soft coking coal (10.3% ash content) from benches 2, 3 and 4, the middlings of which goes to Matimba.
- Thermal coal for The Matimba Power Station from benches 5, 6, 7B and 9A.
- Metallurgical coal from benches 9B and 11.

The whole process is complicated by faulting and the difficulty of horizon control in the pit due to the similarity of the various lithology types.

At Grootegeluk the bench boundaries are provided to the Survey department from the geological model for each bench blast block. These are staked and are drilled to specified depths as determined from the geological model. The blast holes are geophysically logged and interpreted. The block is blasted and the coal loaded and the floors re-surveyed and a reconciliation done to determine the amount of over or under mining that has taken place.

There is a natural discrepancy between the predicted qualities and the actual qualities achieved in the beneficiation plants. This due in part to the discussion above and also due to the liberation factors achieved in core samples crushed to –13mm and RoM part beneficiated at –50mm.

The classification of the resources into Inferred, Indicated and Measured using the control point separation for the Inferred category and the use of a percentage of the 95 percentile of the ordinary kriging estimate divided by the determined kriging estimate of 10% or less determines for each bench the Measured Resource.

Each criterion of the SAMREC Code as defined in the guidelines SANS 10320 : 2004 is covered with reasonable explanation. The process followed to determine the modifying factors and in the classification of the resources and determination of the qualities and yields is sufficient to support the derivation of the declaration and can be expected to provide a reasonable estimation of the Coal Resources and Coal Reserves.

On re-assessing the classification of the resources within the Mining Authorization Area, the expected extraction of 1.6 billion tonnes from the Coal Benches translates into some 0.8 billion tonnes of saleable product. There is more than sufficient Measured and Indicated Resources (3.16 billion in-situ tonnes, discounted for geological losses, at 31 December 2004) within the Mining Authorization Area which could be converted to sufficient Reserves that would support the projected 40-year mining plan. It is SRK's opinion that there would be little or no significant change in the mining economics if the mining layout was to be changed to remain only within the Indicated and Measured Resources. To view the SRK audited Minerals Resource and Reserve statement refer to Table 4.8.

4.3.2 Leeuwpan Mine

Some 1,617 boreholes have been drilled in and around the Mine Authorisation Area. This borehole information has been captured according to the Kumba Standards to a resolution of a minimum of 1cm, with the standard logging codes used to capture the information. The individual geologists who have logged the boreholes are responsible for the complete capture of the related lithological and analytical information into the borehole database which is stored on the Mine. The sampling at the beginning of the exploration programme was in detail with upwards of 30 samples having been taken in the coal measures. At the beginning the sediment partings were sampled. Recent exploration results in some five samples taken in the coal measures and the sediment partings assigned default values. This practice is common accepted practice where sufficient information is available. All analysis of the sample material are done on site at the Coal and Mineral Technologies Laboratory at Delmas (Leeuwpan Colliery), which is a SANAS accredited laboratory (No. TO144). The sample procedure and number of checks and repeats appear to be according to ISO standards.

There is however a slight concern in the relative density determination with a relatively large variability in the correlation between ash content on an air dried basis and the air dried relative density. Checks done on the analytical information provided indicates that although the majority of the data are within the norms that can be expected for South African Coals, there are a minor amount of discrepancies, with 81 occurrences of RD's of below 1.25 some with ash contents as high as 48%. It should be noted however that there are over 10 000 individual samples within the database. All the borehole data (lithology, zone and sample) are captured on the mine and an electronic transfer of the analytical data is obtained from the laboratory and now stored in a SABLE borehole database. The analytical data is checked and validated within the programme to determine variable trends within the fractional analytical data and abnormal analytical results with the physical lithological description.

The implementation of the SABLE database is relatively recent occurrence which occurred during the first quarter of 2004. Previously an in-house DB3 database was used to store, validate and composite all the geological data. The recombining of the individual samples is performed in the SABLE database as is all the compositing of individual samples to Seams. Generally the data is in a reasonable state with only minor errors encountered. The product extrapolation technique as described by the SABLE programming team is a linear extrapolation between known points and in some cases beyond the data. This can induce error. While it is very unlikely to encounter a pristine database this data could easily be validated and corrected.

Geological modeling of the composited analytical and structural data is undertaken in MINCOM's Stratmodel and the resultant grids are exported to XPAC for Mine scheduling. Visual inspection of the computer model appeared to reflect the complexity and variability that could be expected from this type of coal deposit. Validation of the model was undertaken in a comparison of the resource calculations for the specific resource blocks and discrepancy due to the software package is in line with that encountered on other mines and mining companies with a correlation factor of approximately 0.95 being achieved. The determination of the amount of coal available in each of the resource blocks indicates a reasonable estimation. There are a

number of issues that appear to be unique to Leeuwpan Mine. The Coal Resource and Coal Reserve Statements indicate that there were numerous expectations on the right of tenure that have been propagated over a number of years.

The mine does not have security of tenure over the entire surface of the mining authorisation area. Subsequent to the mine visit, a document supplied by Kumba indicated that the application for the conversion of the farms Wolvenfontein 244IS portion 8, Rietkuil 249IR portions 1 and 2, Weltevreden 227IS portion 7, and Moabvelden 248IR portion 4 had been refused and this decision is under appeal. Based on an opinion from Kumba's legal counsel, SRK has accepted that the conversion application should be successful and has included the coal resources on these properties in the projections.

To view the SRK audited Minerals Resource and Reserve statement refer to Table 4.9.

4.3.3 Tshikondeni Mine

Some 1,558 boreholes have been drilled in and around the Mine Authorisation area. This borehole information has been captured according to the Kumba Standards to a resolution of a minimum of 1cm, with the standard logging codes used to capture the information. The individual geologists who have logged the boreholes are responsible for the complete capture of the related lithological and analytical information into the borehole database which is stored on the mine. At the current stage in the mine's life there is no more active exploration drilling taking place. However percussion and cored surface boreholes are occasionally drilled to determine structurally complex areas close to the active mining faces. The apparent integrity of the geological data on the mine is good. Additional geological data gathering is obtained by underground horizontal drilling, pillar channel samples and grab samples from the belts. The horizontal drilling procedure used at Tshikondeni to determine more accurately the positions of major structural features close to mining faces is very similar to the practices applied in other structurally complex areas. The survey and analysis of any core recovery is handled in a reasonable manner. The channel sampling of the pillars is used to determine the accuracy of the overall geological model and determine plant feed coal qualities. The inherent limitations of this method of sampling are well-understood by the geological personnel on the mine. Belt grab samples are also used and these samples are routinely sent to the ACT laboratories, which adheres to all relevant standards and procedures and is currently in the process of being accredited with SANAS, for more detailed petrographic analysis. All the locally derived samples are analysed on the mine at the mine laboratory with the exception of the exploration boreholes and some of the belt grab samples. All RD determinations are done on the mine.

All the borehole data (lithology, zone, sample and analysis) are captured on the mine and stored in a GeoLog geological database and imported into a SURPAC block modelling package. The GeoLog geological database is used to composite the samples and washabilities before this information is imported into the SURPAC model. The SURPAC model is used to create DTMs of the upper and lower surfaces of the selected mining horizon and to assign coal qualities to individual resource blocks before this information is exported to XPAC for mine scheduling. The analytical data is checked and validated within the GeoLog programme to determine variable trends within the fractional analytical data and abnormal analytical results with the physical lithological description. An additional step of correcting the yield at certain fractions due to crushing and coreloss during drilling has been applied to compensate of the inherent softness of the coal and to better estimate the plant yield.

The incorporation of a risk matrix in the XPAC scheduling to determine the probable extraction factors and mining and in-panel geological losses. In light of the amount of information that is collected and processed, the very small deviances encountered in the coal quality reconciliation of 2%, 2% and 1% for the monthly, weekly and daily reports tends to indicate a competent database. The determination of the amount of coal available in each of the resource blocks is as stated in the section on geological modelling indicates a reasonable estimation. As only the coal that is considered to be readily mineable has been included in the resource statements with the slight exception of the corner of the Goni block that is outside of the mining authorisation.

The control point density is well within the SAMREC definitions for Indicated and Measured Resources as applied to coal and is in the opinion of SRK SAMREC compliant.

To view the SRK audited Minerals Resource and Reserve statement refer to Table 4.10.

4.3.4 Arnot Colliery

The primary means of exploration is through the drilling of vertical, fully-cored (~60mm, TNW), diamond-drilled boreholes. All drilling is undertaken by established drilling companies with sufficient and relevant experience in the South African Coalfields. Core retrieved can thus be assumed to be representative of the strata penetrated, including coal Seams intersected. All core logging is currently undertaken by suitably

qualified geologists with relevant experience in coal exploration and mining. Core logging is quantitative to a sufficiently high level of detail to allow for appropriate sedimentological studies, e.g. litho-stratigraphic correlation, to be undertaken, including coal resource estimation.

Since the coal Seams are relatively flat lying and undeformed with respect to folding, Seam thicknesses, as measured by logging (down-hole length), are considered to be equal to the true Seam thickness where vertical boreholes have been drilled. To SRK's knowledge, no inclined boreholes have been drilled at Arnot during Eyesizwe's ownership of the mine. No information regarding sample recovery was supplied, or appears to be available.

However, given that the drilling is undertaken by experienced personnel and that the logging is carried out by a suitably qualified geologist, it can be reasonably assumed that recorded, and captured, data regarding cored coal intersections are accurate and representative of the full Seam, or the select portion thereof. All intersections through coal Seams of economic interest, namely the No. 2L, and of sufficient length, typically greater than 30cm, are submitted for analysis Midlab coal laboratory in Middelburg. Arnot supplies primarily a RoM, unbeneficiated product directly to Eskom's Arnot Power Station. Approximately 14% of the RoM is destoned in a dense-medium beneficiation plant, washing at a relative density of 2.0. Analyses are thus typically restricted to the proximate analyses, calorific value ("CV") and total Sulphur ("TS"). Although Midlab is not SANAS accredited, SRK was not made aware of any significant discrepancies between forecast coal qualities and reconciled actual qualities (the power station also performs checks on RoM coal).

No other substantive exploration data has been supplied to SRK.

All borehole positions are surveyed (Lo system) by the mine's survey personnel and these positions are considered accurate to allow for geological modelling to be performed. The verification of core logging and laboratory results is undertaken by the mine geologist. In the case of anomalous laboratory results, the reference sample can be analysed. Anomalous logging results can be clarified and corrected in the field before the core is destroyed. If poor drilling results in significant core losses, re-drilling of boreholes can be requested. Twinning of older boreholes can also be performed. Eyesizwe makes use of a computer-based borehole database known as the Geological Borehole Information System ("GBIS"). This database has built-in data validation procedures that are executed routinely as information is entered into the database.

Although SRK was supplied plans indicating the geographic localities of boreholes used in the geological modelling of the particular Seams within the Arnot mining areas, SRK did not independently classify the resources in terms of SANS 10320 and, therefore, cannot comment on the validity and accuracy of the SAMREC classification of resources as reported by Arnot as per the supplied Coal Resource and Coal Reserve Statement. SRK is however satisfied that sufficient boreholes, at relevant spacing, have been drilled to confidently classify the resources accordingly. SRK is therefore satisfied that the Coal Resources and Coal Reserves stated herein are SAMREC compliant.

The Minex geological modelling software programme is used to model all validated data exported from the GBIS. The Growth Algorithm is used to interpolate the various parameters between points of observation, i.e. boreholes. This algorithm is a trended geostatistical estimator and is considered to be adequate for interpolation and modelling in most South African Coalfield scenarios. Once the data is modelled, grids of controlling surfaces can be generated. Controlling surfaces include physical and coal quality parameters. Estimates of Coal Resources can then be performed for polygons defined within the gridded areas.

The definition of polygons is initially controlled by the physical and coal quality cut-off parameters applied at Arnot. These cut-off parameters, for the various Seams, are tabled in Table 4.5.

Table 4.5 Arnot Colliery: Physical and Quality Cut-off Parameters

Seam	Depth to Floor (m)	Min. Seam Thickness (m)	Max. Strip Ratio (bcm : t)	Min. Volatiles (%, air dry)	Min. C.V. (MJ/kg, dry)
S2L	20 (min)	1.80	N/A	18.00	23.30
S1	N/A	N/A	6:1	18.00	23.30

N/A: Not Applicable.

To view the SRK audited Minerals Resource and Reserve statement refer to Table 4.11.

4.3.5 Matla Colliery

The primary means of exploration is through the drilling of diamond-core boreholes. Drilling is currently undertaken by several established drilling companies considered to have sufficient experience in diamond-core drilling in the South African Coalfields. Core retrieved can therefore be expected to be representative of the sedimentary successions penetrated and core recoveries to be of an acceptable standard. All holes are

fully cored TNW (~60mm diameter) size. All core logging is currently undertaken by suitably qualified geologists with relevant experience in coal exploration and mining. Core logging is quantitative to a sufficiently high level of detail to allow for appropriate sedimentological studies, e.g. litho-stratigraphic correlation, to be undertaken, including coal resource estimation. Since the coal Seams are relatively flat lying and undeformed with respect to folding, Seam thicknesses, as measured by logging (down-hole length), are considered to be equal to the true Seam thickness where vertical boreholes have been drilled.

To SRK's knowledge, no inclined boreholes have been drilled at Matla. No information regarding sample recovery was supplied, or appears to be available. However, given that the drilling is undertaken by experienced personnel and that the logging is carried out by a suitably qualified geologist, it can be reasonably assumed that recorded, and captured, data regarding cored coal intersections are accurate and representative of the full Seam, or the select portion thereof.

All intersections through coal Seams of economic interest, namely the No. 5, the No. 4 and the No. 2 and of sufficient length, typically greater than 30cm, are submitted for analysis. Matla supplies a RoM, unbeneficiated product directly to Eskom's Matla Power Station and therefore analyses are typically restricted to the proximate analyses, calorific value ("CV") and total Sulphur ("TS"). Matla has an on-mine laboratory, and although not SANAS accredited nor audited during the technical visit, SRK was not made aware of any significant discrepancies following discussions with relevant colliery personnel between forecast coal qualities and reconciled actual qualities (the power station also performs checks on RoM coal). Presently, the No. 5 Seam is not mined.

No other substantive exploration data has been supplied to SRK.

All borehole positions are surveyed (Lo system) by the mine's survey personnel and these positions are considered accurate to allow for geological modelling to be performed.

The verification of core logging and laboratory results is undertaken by the mine geologist. In the case of anomalous laboratory results, the reference sample can be analysed. Anomalous logging results can be clarified and corrected in the field before the core is destroyed. If poor drilling results in significant core losses, re-drilling of boreholes can be requested.

Twinning of older boreholes can also be performed. SRK was not supplied information and/or plans indicating the total number, and geographic localities, of boreholes used in the geological modelling of the particular Seams within the Matla mining areas. SRK cannot therefore comment on the validity and accuracy of the SAMREC classification of resources as reported by Matla as per the supplied Coal Resource and Coal Reserve statement.

Given the extensive history of the mine, however, it can be reasonably assumed that sufficient boreholes have been drilled to allow for adequate geological modelling to be performed allowing for reasonable estimates of coal resources to be made. SRK is therefore satisfied that the Coal Resources and Coal Reserves stated herein are SAMREC compliant.

The Minex geological modelling software programme is used to model all validated data exported from the GBIS. The Growth Algorithm is used to interpolate the various parameters between points of observation, i.e. boreholes. This algorithm is a trended geostatistical estimator and is considered to be adequate for interpolation and modelling in most South African Coalfield scenarios. Once the data is modelled, grids of controlling surfaces can be generated. Controlling surfaces include physical and coal quality parameters. Estimates of coal resources can then be performed for polygons defined within the gridded areas. The definition of polygons is initially controlled by the physical and coal quality cut-off parameters applied at Matla. These cut-off parameters, for the various Seams, are tabled in Table 4.6 (where this information has been provided).

Table 4.6 Matla Colliery: Physical and Quality Cut-off Parameters

Seam	Min. Seam thickness (m)	Cut-off Parameters	
		Min. Volatiles (% , air dry)	Min. raw CV (MJ/kg, air dry)
S5	1.30	18.00	22.00
S4	2.50	18.00	17.00
S2	1.80	18.00	22.00

The Coal Resource and Coal Reserve statement as developed and submitted by Matla has been audited by SRK and, where necessary, adjustments made. The SRK – revised Coal Resources and Reserves can be seen in Table 4.12.

To view the SRK audited Minerals Resource and Reserve statement refer to Table 4.12.

4.3.6 New Clydesdale Colliery

New Clydesdale Colliery has been explored, primarily through the drilling of vertical boreholes (cored), by several mining houses, namely Gold Fields of South Africa, Anglo Coal, and more recently, Eyesizwe. Over the 40 years of exploration and mining at New Clydesdale Colliery, numerous geologists have logged core, sampled coal and compiled geological models. The current geological model has incorporated into it all relevant historical information, where it has been deemed to be of a suitable quality.

The primary means of exploration is through the drilling of diamond-cored boreholes. Drilling is currently undertaken by several established drilling companies considered to have sufficient experience in diamond-core drilling in the South African Coalfields. Core retrieved can therefore be expected to be representative of the sedimentary successions penetrated and core recoveries to be of an acceptable standard. All holes are fully cored, TNW (60mm diameter) size.

All core logging is currently undertaken by suitably qualified geologists with relevant experience in coal exploration and mining. Core logging is quantitative to a sufficiently high level of detail to allow for appropriate sedimentological studies, e.g. litho-stratigraphic correlation, to be undertaken, including coal resource estimation. Since the coal Seams are relatively flat lying and undeformed with respect to folding, Seam thicknesses, as measured by logging (down-hole length), are considered to be equal to the true Seam thickness where vertical boreholes have been drilled. To SRK's knowledge, no inclined boreholes have been drilled at New Clydesdale Colliery.

No information regarding sample recovery was supplied. However, given that the drilling is undertaken by experienced personnel and that the logging is carried out by suitably qualified geologists, it can be reasonably assumed that recorded, and captured, data regarding cored coal intersections are accurate and representative of the full Seam, or the select portion thereof.

All intersections through coal Seams of economic interest, namely the No. 4 Upper and Lower Seams, the No. 2 Seam and the No. 1 Seam and of sufficient length, typically greater than 30cm, are submitted for analysis. All selected coal Seams and sub-Seams are submitted to a coal analytical laboratory for proximate and full washability analyses. Sufficient density fractions are selected to allow for comprehensive wash-tables to be generated. All coal samples are submitted to either Babu's Laboratory Services in Middelburg or Wittlab in Witbank. Although these laboratories are not SANAS accredited facilities, no indication of poor service and/or results have been communicated to SRK. These laboratories are well-known in the region and SRK has confirmed their service standards with other users.

Sample security, preparation and handling was not discussed, neither was any information in this regard submitted to SRK and therefore no comment can be made. SRK was not made aware of any previous audits or reviews of sampling techniques and results, however, SRK was informed that all samples with washability data have been archived at the mine and can be made available for inspection if necessary. SRK does not consider this necessary for the purposes of this technical audit.

No other substantive exploration data has been supplied to SRK.

All borehole positions are surveyed (Lo system) by the mine's survey personnel and these positions are considered accurate to allow for geological modelling to be performed. Accurate terrain modelling is done using DTM based on flight data from 2001. All borehole collars are adjusted to this DTM.

In the Diepspruit/Middeldrift/Vaalkrans South coal resource areas, a total of 251 diamond-cored boreholes have been drilled. A total of 60 diamond-cored boreholes have been drilled in the Vaalkrans North coal resource area; 26 of the 60 were drilled to the base of the No. 4 Lower Seam.

The verification of core logging and laboratory results is undertaken by the mine geologist. In the case of anomalous laboratory results, the reference sample can be analysed. Anomalous logging results can be clarified and corrected in the field before the core is destroyed. If poor drilling results in significant core losses, re-drilling of boreholes can be requested. Twinning of older boreholes can also be performed.

The density and distribution of cored and sampled boreholes within the planned mining areas is sufficient, in terms of SANS 10320, for coal resources to be estimated with a high degree of confidence. Coal resources within the planned mining areas are considered Measured Resources.

The Minex geological modelling software programme is used to model all validated data exported from the GBIS. The Growth Algorithm is used to interpolate the various parameters between points of observation, i.e. boreholes. This algorithm is a trended geostatistical estimator and is considered to be adequate for interpolation and modelling in most South African Coalfield scenarios. Once the data is modelled, grids of controlling surfaces can be generated. Controlling surfaces include physical and coal quality parameters.

Estimates of coal resources can then be performed for polygons defined within the gridded areas. The definition of polygons is initially controlled by the physical and coal quality cut-off parameters applied at New Clydesdale Colliery. These cut-off parameters vary for the various Seams.

The Coal Resource and Coal Reserve Statement as developed and submitted by New Clydesdale Colliery has been audited by SRK and, where necessary, adjustments made. The SRK – revised Coal Resources and Reserves can be seen in Table 4.13.

To view the SRK audited Minerals Resource and Reserve statement refer to Table 4.13.

4.3.7 North Block Complex

North Block Complex comprises several identified resource areas as follows:

- Eerstelingsfontein opencast;
- Glisa South underground; and
- Strathrae opencast.

With the exception of the Eerstelingsfontein area, the remaining two resource areas have previously been owned by various companies over the years, and therefore have been prospected in by several companies (notably Gold Fields Limited and Anglo Coal). Exploration was primarily done through drilling of vertically cored boreholes, and coal samples then taken and analysed at various coal analytical laboratories. It is not possible to comment on the historical sampling and analytical procedures, suffice it to say that the majority of the historical geological and analytical information is incorporated into the current geological and coal quality models.

The primary means of exploration is through the drilling of diamond-core boreholes. Drilling is currently undertaken by Quest Drilling, an established drilling company with sufficient experience in diamond-core drilling in the South African Coalfields. Core retrieved can therefore be expected to be representative of the sedimentary successions penetrated and core recoveries to be of an acceptable standard. All core logging is currently undertaken by Mr H Ludik, a geologist with 14 years' experience in coal exploration and mining. Core logging is quantitative to a sufficiently high level of detail to allow for appropriate sedimentological studies, e.g. litho-stratigraphic correlation, to be undertaken, including coal resource estimation. No information regarding sample recovery was supplied, or appears to be available. However, given that the drilling is undertaken by experienced personnel and that the logging is carried out by a suitably qualified geologist, it can be reasonably assumed that recorded, and captured, data regarding cored coal intersections are accurate and representative of the full Seam, or select portions thereof. All intersections through coal Seams of economic interest, notably the No. 2 Seam, and of sufficient length, typically greater than 50cm, are submitted for analysis.

Typically two samples are generated from every intersection, an upper and a lower sample. The samples are submitted to Coal and Minerals Technology (a SANAS accredited laboratory, certification number T0144) for float and sink analysis. Analyses of the float fractions include ash content, volatile matter, inherent moisture, sulphur content, phosphorous in coal content and calorific value, while fixed carbon is calculated by difference ($1 - (\text{ash}\% + \text{volatile}\% + \text{moisture}\%)$). Each sample is riffle-split after crushing to obtain two representative samples per core sample: one is analysed and one kept for reference (up to three months).

Since the laboratory is an independent, accredited laboratory, it can be reasonably assumed that its standards, procedures and equipment are of a suitably high enough standard to allow for reliable, accurate and repeatable analytical results to be derived. It is for this reason that SRK did not undertake to audit the laboratory. Sample results are later composited to derive the raw quality for the total interval sampled.

SRK has not been made aware of any previous audits or reviews of sampling techniques and results. SRK considers that current sampling techniques and methodologies along with resultant analytical results are adequate for the intended operation. Professional, independent surveyors, Eugene Pretorius and Associates ("EPA"), are contracted to North Block Complex to perform all survey work, including the setting out and re-surveying of all drill holes. SRK is of the opinion that EPA conducts their work to high enough standards such that spatial information supplied to the geologist allows for accurate topographic and geological modelling to be performed. Since the coal Seams are relatively flat-lying and undeformed with respect to folding, Seam widths, as measured by logging (down-hole length), are considered to be equivalent to true Seam thickness where vertical boreholes have been drilled. To SRK's knowledge, no inclined boreholes have been drilled.

No other substantive exploration data has been supplied to SRK.

The following are assessed independently:

- Eerstelingsfontein Opencast

Thirty-three diamond-core boreholes (60mm core diameter) have been drilled within the mining lease area. To SRK's knowledge, no exploration has been conducted in the Eerstelingsfontein block by any other parties. Approximately 55 additional boreholes are planned for this area. 30 holes will be drilled to better define the proposed box-cuts, while 25 holes will be drilled to firm up on coal physical (structural) and quality continuity within the block.

- Glisa South Underground

At least 37 diamond-core boreholes (60mm core diameter) have been drilled on portions 28, 29 and 30 of Paardeplaats 380 JT (Belfast district) to define the resource block for the Glisa South underground operations. Since the Glisa South resources have, in the past, been owned by various mining houses, exploration by those parties has undoubtedly been undertaken during those periods, and those exploration results have been incorporated into the current geological model. Exploration by Eyesizwe has also been undertaken in recent times, with several Eyesizwe geologists being involved at various stages. An additional 40 boreholes are planned for the Glisa South underground target area, however, a prospecting licence has, to date, not yet been obtained.

- Strathrae Opencast

- Grootpan/Klippan:

A total of 54 boreholes have been drilled to define the opencastable limits of the No. 2 Seam in this area. However, only 39 of these holes have, or appear to have, been appropriately sampled (according to information received by SRK). Only these boreholes can be used to comprehensively categorise the resources within the target mining area. No additional boreholes are planned for this opencast resource.

- Main Plant West Pit:

A total of 83 boreholes have been drilled to define the mineable limits of coal in this area. A seasonal river traverses the area in a north-south direction and hence two pits (Pit A and Pit B) are defined. Ten additional boreholes are planned in order to determine the exact position of the box-cut in Pit A (three) and to firm up on in-pit qualities (seven).

The verification of laboratory results is undertaken by the mine geologist. In the case of anomalous results, the reference sample can be analysed. Eyesizwe makes use of a Minex-based borehole database known as the Geological Borehole Information System ("GBIS"). This database has built-in data validation procedures that are executed routinely as information is entered into the database.

The quality and quantity of data for each of the following is assessed independently:

- Eerstelingsfontein Opencast

The distribution and density of boreholes drilled in the Eerstelingsfontein block is sufficient to allow for the Coal Resources, in terms of physical and quality continuity, to be estimated with a high degree of confidence. Coal resources within the planned mining area are considered to be Measured Resources.

- Glisa South Underground

The distribution and density of boreholes drilled in the targeted underground mining area is currently insufficient to allow detailed mine planning. The resources within this area are classified as Inferred Resources.

- Strathrae Opencast

The distribution and density of boreholes drilled to define the opencast resources is sufficient to allow for the resources, in terms of physical and quality continuity, to be estimated with a high degree of confidence. Coal resources within the planned mining area are considered to be Measured Resources.

The Minex geological modelling software programme is used to model all validated data exported from the GBIS. The Growth Algorithm is used to interpolate the various parameters between points of observation, i.e. boreholes. This algorithm is a trended geostatistical estimator and is considered to be adequate for interpolation and modelling in most South African Coalfield scenarios. Once the data is modelled, grids of controlling surfaces can be generated. Controlling surfaces include physical and coal quality parameters.

Estimates of coal resources can then be performed for polygons defined within the gridded areas. The definition of polygons is initially controlled by the physical and coal quality cut-off parameters applied at North Block Complex. These cut-off parameters, for the various Seams, are tabled in Table 4.7.

Table 4.7 North Block Complex: Physical and Quality Cut-off Parameters

Seam	Mining Method	Minimum Seam Thickness	Maximum Strip Ratio (BCM Waste : Tonne Coal)	Minimum Depth to Roof	Calorific Value (<i>in situ</i> , aduc)
S2, S2L	O/C	1.00m	6 : 1	N/A	N/A
S2S, S2L	UG	1.80m	N/A	25m	24MJ/kg

N/A: Not Applicable.

The Coal Resource and Coal Reserve Statement as developed and submitted by North Block Complex has been audited by SRK and, where necessary, adjustments made. The SRK – revised Coal Resources and Reserves can be seen in Table 4.13.

To view the SRK audited Minerals Resource and Reserve statement refer to Table 4.14.

4.3.8 Inyanda Project

The feasibility study has been completed and the documentation for the Southern resource block of 137Ha, has a detailed study of the analysis, and logging of the boreholes used to determine the Coal Resource. The resource is based on the 36 boreholes with reliable information, which translates to an average hole spacing of 195m.

Detailed sampling of the coal Seams was undertaken and analysis done in great depth. Average theoretical yields for a 6000Kcal NAR product for the 1 Seam and 2 Seam are 79.9% and 87.2%, respectively. The average parting, which consists of sandstone, is expected to be mined with both Seams concurrently with a significant decrease in the overall yield.

The effects of the dolerite sill in the floor of the 1 Seam, while not readily apparent in the gross volatiles, appears to have an effect on the coal qualities of this Seam in boreholes KB12 and KB11. Considering the amount of information gathered and the processing of the data in the opinion of SRK the resources are SAMREC compliant.

To view the SRK audited Minerals Resource and Reserve statement refer to Table 4.15.

4.3.9 Mafube JV Phase II Project

The feasibility study has been completed and the documentation for the two major resource areas, Springboklaagte and Nooitgedacht, has a detailed study of the analysis, logging and modeling procedure used to determine the Coal Resource. A detailed account is provided on the discount factors used to determine the resource, based on geological risk domains. In addition full account is provided of the data distribution with respect to the boreholes used in the determination of the resource. It should be noted that remnant coal in the old Coronation colliery is being planned to be extracted on the northern edge of Springboklaagte.

It is the opinion of SRK that the Resources and Reserves stated may be considered to be SAMREC compliant. To view the SRK audited Minerals Resource and Reserve statement refer to Table 4.16.

4.3.10 Belfast Project

Only the No. 2 has economic potential. No major intrusions are known in the Belfast project area. The No. 2 and No. 3 Seams outcrop on the surface. No major faults have been observed in the Belfast area.

The No. 2 Seam thickness varies from the 1.0m cut-off to 4.33m with an average thickness of 2.83m. The No. 2 Seam thickness is negatively affected by interbedded in-Seam mudstone and sandstone in a limited area towards the north-east with the effect that there are significant drops in the +6,000 Kcal NAR product yield, hence the use of a 50% theoretical yield cut-off. The No. 2 Seam floor elevation is relatively flat with dips of less than 3° to the south. Sulphur is very low at less than 0.5% for all products. The significant amount of drilling done since the J T Boyd pre-feasibility study conducted in 2003 has increased the confidence in the stability of the resource with good control on the Limit of Weathering in the opencast areas. Considering the amount of recent work done on the project it is reasonable to expect that the Coal Resource determination is valid.

It is the considered opinion of SRK that the Resources and Reserves stated are considered to be SAMREC compliant. To view the SRK audited Minerals Resource and Reserve statement refer to Table 4.17.

4.3.11 Ingcambu Project

The planned mining and obtained Mining Right is currently restricted to portion 26 of the farm Uitgevallen. The coal Seams that make up the majority of the resource are the C Lower, C Upper and in places the B Lower and B Upper Seams.

To view the SRK audited Minerals Resource and Reserve statement refer to Table 4.18.

4.3.12 Strehla Project

The Strehla Coal deposit has been evaluated using a total of 66 boreholes of which only 20 have been drilled by Kumba. These boreholes were used to construct a 3D model from which the Coal Resources were estimated. This work has outlined a total in-situ raw coal resource of 22Mt, which is classified as Indicated.

It is the considered opinion of SRK that the Resources and Reserves stated are SAMREC compliant. To view the SRK audited Minerals Resource statement refer to Table 4.19.

4.3.13 Moranbah South Project⁽¹⁾

The pre-feasibility study up-date by International Mining Consultants (“IMC”) contains a re-assessment of the data available at Moranbah South. The 77 bore holes drilled into the area on the 2km x 1km grid were used by Iscor (Kumba) and IMC to determine the Coal Resources within the EPC. The drill spacing at Moranbah South exceeds that required by the JORC Code to allow any of the resources to be reported as reserves in Australia, thus, they must be considered only as indicated and inferred resources. Although these figures are not intended to be used for public reporting purposes, IMC has re-estimated the coal resources contained within the controlled limits of EPC 548 and EPC 602 based on the JORC guidelines.

The HCK Seam is the southern equivalent of the Goonyella Middle Seam. However, in the Moranbah South area, the Seam is thinner (due to splitting) and an in-Seam parting is prevalent in the north and west, decreasing to the south and east. This parting markedly decreases product yield as it can total over 50cm thick.

Product ash content for Moranbah South after beneficiation can range from 8.5% to 9.5%. A product ash of 9.5% was selected for the 1996 pre-feasibility study, which is similar to the product ash specification for Goonyella/Riverside and Peak Downs Mines. Geotechnical considerations (as determined by IMC), however, indicate that mining in the northern area is preferable to the south. Yields will vary in the northern area depending on the product ash specification.

The coking properties of all Seams in the Bowen Basin decrease to the east as known from Goonyella and Peak Downs Mines. The HCK Seam at Moranbah South is no exception. In particular Coal Rank (RV max) increases from 1.30 at 180m cover to 1.65 at 500m of cover, with a marked change occurring at about 400m of cover.

The Information provided in the IMC pre-feasibility report suggests that a thorough assessment of the available data had been carried out and that the assessment of the Coal Resources can be considered to be reasonable.

To view the SRK audited Minerals Resource statement refer to Table 4.20.

4.3.14 SRK Audited Resource and Reserve Statements

The Table 4.8, Table 4.9 and Table 4.10 presented in this section present SRK’s audited estimates of the Coal Resource and Coal Reserve for the Kumba Coal assets. The terms and definitions are those given in the South African National Standard 10320 : 2004 Edition 1, “South African guide to the systematic evaluation of Coal Resources and Coal Reserves” developed by the SAMREC Coal Commodity Specific sub-Committee.

(1) The 1999 Australasian Code for the Reporting of Mineral Resources and Ore Reserves (Joint Ore Reserves Committee of The Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists, and Minerals Council of Australia (JORC)), including clauses 37 to 40 (Reporting on Coal Resources and Reserves); and 1999 Guidelines for the Estimation and Reporting of Australian Black Coal Resources and Reserves.

Table 4.8 Grootegeluk Mine: SRK – Audited Coal Resources and Coal Reserves (at 1 January 2006)

SALEABLE COAL RESERVES ⁽¹⁾ (air dry)		RoM COAL RESERVES ⁽¹⁾ (air dry contaminated)						MINEABLE IN-SITU COAL RESOURCES					
Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%)	Ash (%)	S (%)	Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%)	Ash (%)	S (%)	Category	Tonnage (Mt)
Proved						Proved						Measured	
Metallurgical Thermal	31.6 246.0	29.1 20.8	24.5 24.5	10.0 31.8	0.6 1.4	Opencast	673.0	15.6	20.2	45.3	1.5		1,428
Semi-soft Coking	41.9	28.9	35.9	10.3	1.0								
Probable						Probable						Indicated	
Metallurgical Thermal	0.7 28.4	29.1 20.9	24.5 24.6	10.0 31.9	0.6 1.3	Opencast	66.4	15.7	20.2	45.0	1.7		2,075
Semi-soft Coking	19.3	29.0	36.3	10.3	1.1								
Total Proved and Probable Saleable Coal Reserves	367.9					Total Proved and Probable RoM Coal Reserves	739.4					Total Measured and Indicated Coal Resources	3,503
												Inferred	
												Grootegeluk	2,513
												Grootegeluk West	6,075
Total Saleable Reserves	367.9					Total RoM Reserves	739.4					Total Inferred Coal Resources	8,588
												Total Resources	12,091

(1) Resources are inclusive of Reserves.

Table 4.9 Leeuwpan Mine: SRK – Audited Coal Resources and Coal Reserves (at 1 January 2006)⁽¹⁾

SALEABLE COAL RESERVES (air dry)		RoM COAL RESERVES (air dry contaminated)					MINEABLE IN-SITU COAL RESOURCES						
Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%)	Ash (%)	S (%)	Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%)	Ash (%)	S (%)	Category	Tonnage (Mt)
Proved													
Eskom	22.3	22.0	21.0	28.0	0.7	Opencast	95.1	18.0	16.0	30.0	1.0	Opencast	100.1
Export	3.0	27.5	21.0	14.5	0.9	Rom Stockpile	1.0						
Domestic	17.2	22.0	21.0	28.0	0.7								
Metallurgical	15.2												
Probable													
Eskom	12.4	22.0	21.0	28.0	0.7	Opencast	31.4	18.0	16.0	30.0	1.0	Opencast	33.05
Export	1.8	27.5	21.0	14.5	0.9	Underground	16.2	24.0	23.0	22.0	0.9	Underground	27.01
Domestic	10.2	22.0	21.0	28.0	0.7								
Metallurgical	9.0												
Total Proved and Probable Saleable Coal Reserves	91.0					Total Proved and Probable RoM Coal Reserves	143.7					Total Measured and Indicated Coal Resources	160.16

Inferred															
Total Inferred Coal Resources															
Total Saleable Reserves	91.0						Total RoM Reserves	143.7						Total Resources	160.16

(1) The overall yield of 64.28% reflects the fact that more RoM coal is bypassed to create a 30% Ash content coal sold to Eskom. Resources are inclusive of Reserves.

Resources without security of tenure represent some 147Mt (92%) and RoM Reserves without security of tenure represent some 130Mt (90%).

Table 4.9A Leeuwpan Mine: Effect of Land Tenure Applications

Resource Block	Classification	Old Order		Mining		Reserves without	
		Mineral Rights	Surface Rights	Authorisations	Security of tenure	Security of tenure	Security of Tenure
OG	Indicated	YES	YES	YES	YES		
OJ	Indicated	YES	PART	YES	YES	15.51	14.74
OL	Indicated	YES	PART	YES	YES	16.41	15.59
U12	Indicated	YES	PART	PART	PART	28.43	17.05
OD	Measured	YES	YES	PART	PART	10.83	10.29
WELT (OWM)	Measured	YES	PART	PART	YES	76.01	72.21
OH	Measured	YES	YES	YES	YES		
OM	Measured	YES	YES	YES	YES		
Total						147.19	129.88

Table 4.10 Tshikondeni Mine: SRK – Audited Coal Resources and Coal Reserves (at 1 January 2006)

SALEABLE COAL RESERVES										RoM COAL RESERVES					MINEABLE IN-SITU COAL RESOURCES					
Category	Tonnage (Mt)	CV (MJ/kg) (db)	Vol (%) (db)	Ash (%) (db)	S (db) (%)	Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%) (ad)	Ash (%)	S (%)	Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%) (ad)	Ash (%)	S (%)	Category	Tonnage (Mt)	
Proved						Proved						Measured						Indicated		
Coking	3.2	31.8	21.2	12.4	0.77	Underground	6.2	±22	±18	32	±1.20	Underground	25.7					Underground	25.7	
						Probable						Underground	10.1							
Total Proved and Probable Saleable Coal Reserves⁽¹⁾	3.2					Total Proved and Probable RoM Coal Reserves⁽¹⁾	6.2					Total Measured and Indicated Coal Resources	35.8							
Total Saleable Reserves	3.2					Total RoM Reserves	6.2					Total Inferred Coal Resources								

Resources are inclusive of Reserves.

Only Raw Ash Content and Yield are determined for Raw Coal, therefore other RoM Coal Qualities are preceded by “±”.

All Saleable Coal Qualities are laboratory-determined.

Table 4.11 Arnot Colliery: SRK – Audited Coal Resources and Coal Reserves (at 1 January 2006)

SALEABLE COAL RESERVES (Dry – Partial Destone)				RoM COAL RESERVES (Raw Dry Contaminated)				MINEABLE IN-SITU COAL RESOURCES					
Category (Mt)	Tonnage (MJ/kg)	CV (%)	Vol (%)	Ash (%)	S	Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%)	Ash (%)	S (%)	Category	Tonnage (Mt)
Proved Probable	67.1	24.0	23.6	24.38	1.0	Proved Probable	70.3	23.7	23.4	25.1	1.1	Measured Indicated	102.6 113.5
Total Proved and Probable Saleable Coal Reserves	67.1	24.0	23.6	24.38	1.0	Total Proved and Probable RoM Coal Reserves	70.3	23.7	23.4	25.1	1.1	Total Measured and Indicated Coal Resources	216.1
Inferred													
Total Inferred Coal Resources													
Total Saleable Reserves	67.1	Total RoM Reserves		70.3	Total Resources		216.1						

Resources are inclusive of Reserves and sales qualities are dry.

Not stated in the above table are the 48Mt of Inferred Coal Resources.

Table 4.12 Matla Colliery: SRK – Audited Coal Resources and Coal Reserves (at 1 January 2006)

SALEABLE COAL RESERVES (Raw air dry)		ROM COAL RESERVES (Raw air dry)						MINEABLE IN-SITU COAL RESOURCES					
Category	Product Tonnage (Mt)	CV (AD) (MJ/kg)	Vol (AD) (%)	Ash (AD) (%)	S (AD) (%)	Category	Tonnage (Mt)	CV (Raw AD) (MJ/kg)	Vol (Raw AD) (%)	Ash (Raw AD) (%)	S (Raw AD) (%)	Category	Tonnage (Mt)
Proved						Proved						Measured	
Mine 1	30	21.7	23.5	23.1	0.87	Mine 1	30.6	21.7	23.5	23.1	0.87	Mine 1	54.15
Mine 2	122.4	24.1	24.5	18.5	0.84	Mine 2	126.3	24.1	24.5	18.5	0.84	Mine 2	164.47
Mine 3	71.2	18.1	21.6	34	0.92	Mine 3	73.1	18.1	21.6	34	0.92	Mine 3	110.37
Probable						Probable						Indicated	
Mine 1	40.1	21.7	23.5	23.1	0.87		41	21.7	23.5	23.1	0.87	Mine 1	72.27
Mine 2	26.1	18.1	21.6	34	0.92		26.3	18.1	21.6	34	0.92	Mine 3	40.5
Total Proved and Probable Saleable Coal Reserves	289.8					Total Proved and Probable RoM Coal Reserves	297.3					Total Measured and Indicated Coal Resources	441.76
												Inferred	
												Total Inferred Coal Resources	
Total Saleable Reserves	289.8					Total RoM Reserves	297.3					Total Resources	441.76

Resources are inclusive of Reserves and sales qualities are dry.

Table 4.13 New Clydesdale Colliery: SRK – Audited Coal Resources and Coal Reserves (at 1 January 2006)

SALEABLE COAL RESERVES (Raw/Washed air dry)										ROM COAL RESERVES (Raw air dry)				MINEABLE IN-SITU COAL RESOURCES			
Category	Product Tonnage (Washed/Raw) (Mt)	CV (AD) (MJ/kg)	Vol (AD) (%)	Ash (AD) (%)	S (AD) (%)	Category	Tonnage (Mt)	CV (Raw AD) (MJ/kg)	Vol (Raw AD) (%)	Ash (Raw AD) (%)	S (Raw AD) (%)	Category	Tonnage (Mt)				
Proved						Proved						Measured (in LoM Plan)					
VKS North O/C 4U Seam	0.8 ⁽¹⁾	20.7	20.4	31.7	0.8	VKS North O/C S4U	0.8	20.7	20.4	31.7	0.87	VKS North O/C S4U	0.9				
VKS North O/C 4L Seam	1.1	26.9	23.5	15.8	1.1	VKS North O/C S4L	1.7	24.5	24.1	20	0.94	VKS North O/C S4L	2.2				
VKS Pillar 2 Seam	0.5	28.5	27.5	11	0.5	VKS Pillar 2 Seam	0.6	27.8	27.5	13	0.89	VKS South Pillars	1.2				
Middelidrift 4L Seam	1.1	27.5	25.4	14.3	1.1	Middelidrift 4L Seam	2.0	25.4	24.1	19.6	1.28	Middelidrift S4L	3.0				
Middelidrift 1 Seam	1.7	27.6	27.3	15.3	1.7	Middelidrift 1 Seam	2.5	24.7	25.6	22.2	1.1	Middelidrift S1	4.3				
Diepspruit 2 Seam Select	4.1	27.6	28.9	14.5	4.1	Diepspruit 2 Seam Select	5.5	25.7	28.8	18.4	0.84	Diepspruit S2S	10.1				
Probable						Probable						Indicated (in LoM Plan)					
VKS Pillars 2 Seam	1.1	28.5	27	11	1.1	VKS Pillars 2 Seam	1.4	27.8	27.5	13	0.89	VKS South Pillars S2S	1.7				
Total Proved and Probable Saleable Coal Reserves	10.2						14.4					Total Measured and Indicated Resources (in LoM Plan)	23.59				
												Measured (not in LoM Plan)					
												VKS Village S2T	0.08				
												VKS Village S2S	0.1				
												VKS Village S2A	0.1				
												Block F ext.	1.6				
												Indicated (not in LoM Plan)					
												VKS North S4L UG	6.8				
												Diepspruit S1	8.6				
												Total Measured and Indicated Resources (not in LoM Plan)	17.2				
												Inferred Total Inferred Coal Resources					
Total Saleable Reserves	10.2					Total RoM Reserves	14.4					Total Resources	40.7				

(1) Raw D-Grade.

Resources are inclusive of Reserves and sales qualities are dry.

Table 4.14 North Block Complex: SRK – Audited Coal Resources and Coal Reserves (at 1 January 2006)

SALEABLE COAL RESERVES (Raw/Washed air dry)										ROM COAL RESERVES (Raw air dry)					MINEABLE IN-SITU COAL RESOURCES		
Category	Product Tonnage (Mt)	CV (AD) (MJ/kg)	Vol (AD) (%)	Ash (AD) (%)	S (AD) (%)	Category	Tonnage (Mt)	CV (Raw AD) (MJ/kg)	Vol (Raw AD) (%)	Ash (Raw AD) (%)	S (Raw AD) (%)	Category	Tonnage (Mt)				
Proved																	
Glisa UG (Ptn 5)	0.35	23.9	24.2	19.9	0.79	Glisa UG (Ptn 5)	0.35	23.9	24.2	19.9	0.79	Measured					
Glisa UG (Ptn 24)	0.15	24.5	23.6	17.7	0.99	Glisa UG (Ptn 24)	0.15	24.5	23.6	17.7	0.99	Klipfontein OC	1.59				
Strathrae West (washed)	0.28	27.6	25.1	11.7	0.6	Strathrae West (washed)	0.5	25.1	24	17.3	0.84						
Strathrae West (raw)	0.45	24.5	21.6	17.8	0.48	Strathrae West (raw)	0.45	24.5	21.6	17.8	0.48						
Strathrae Grootpan – Klippan	3.19	23.1	20.9	21.9	0.73	Strathrae Grootpan – Klippan	3.19	23.1	20.9	21.9	0.73						
Strathrae East	0.49	25.9	23.3	15.6	0.94	Strathrae East	0.49	25.9	23.3	15.6	0.94						
Eerstelingsfontein	2.72	24.3	22.6	18.3	0.85	Eerstelingsfontein	2.72	24.3	22.6	18.3	0.85						
Probable																	
Indicated																	
Glisa South UG 8.26																	
Total Proved and Probable Saleable Coal Reserves		7.63		Total Proved and Probable RoM Coal Reserves		7.85		Total Measured and Indicated Coal Resources		9.85							
Inferred																	
Total Inferred Coal Resources																	
Total Reserves		7.63		Total RoM Reserves		7.85		Total Resources		9.85							

Resources are inclusive of Reserves.

Table 4.15 Inyanda Project: SRK – Audited Coal Resources and Coal Reserves (at 1 January 2006)

SALEABLE COAL RESERVES		RoM COAL RESERVES						MINEABLE IN-SITU COAL RESOURCES					
Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%)	Ash (%)	S (%)	Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%)	Ash (%)	S (%)	Category	Tonnage (Mt)
Proved						Proved						Measured	
Export						Opencast	7.8	25.7	23.8	19.4	1.1	Opencast	15.27
2 Seam	5.7	27.5	24.3	14.0	0.7	2 Seam	6.8	25.1	23.8	22.3	1.4		
1 Seam	4.7	27.9	25.8	14.0	0.7	1 Seam	14.6						
Total Proved and Probable Saleable Coal Reserves	10.4					Total Proved and Probable RoM Coal Reserves						Total Measured and Indicated Coal Resources	15.27
												Inferred	
Total Saleable Reserves	10.4					Total RoM Reserves	14.6					Total Inferred Coal Resources	15.27

Resources are inclusive of Reserves.

Table 4.16 Mafube JV Phase II Project: SRK – Audited Coal Resources and Coal Reserves (at 1 January 2006)

RoM COAL RESERVES										MINEABLE IN-SITU COAL RESOURCES			
Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%)	Ash (%)	S (%)	Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%)	Ash (%)	S (%)	Category	Tonnage (Mt)
Proved						Proved						Measured	
Export Thermal	20.0	27.5	21.0	11.5	0.4	Opencast	43.9	23.9	22.4	20.6	1.0	Opencast	47.64
	15.8	23.2	26.0	25.9	0.6								
Probable	0.0					Probable						Indicated	
Export Thermal	20.4	27.5	21.0	11.5	0.4	Opencast	44.8	23.1	22.8	22.3	1.0	Opencast	46.54
	16.1	23.2	21.6	25.9	0.6								
Total Proved and Probable Saleable Coal Reserves	72.4					Total Proved and Probable RoM Coal Reserves	88.8					Total Measured and Indicated Coal Resources	94.19
												Inferred	45.18
												Total Inferred Coal Resources	45.18
Total Saleable Reserves	72.3					Total RoM Reserves	88.8					Total Resources	139.37

Resources are inclusive of Reserves.

Table 4.17 Belfast Project: SRK – Audited Coal Resources and Coal Reserves (at 1 January 2006)

SALEABLE COAL RESERVES										RoM COAL RESERVES					MINEABLE IN-SITU COAL RESOURCES		
Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%)	Ash (%)	S (%)	Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%)	Ash (%)	S (%)	Category	Tonnage (Mt)				
Proved						Proved						Measured					
Export Thermal	8.6	27.5	24.5	11.7	0.4	Opencast	15.0	25.7	23.3	16.5	1.2	Opencast	14.61				
Export Thermal	4.5	21.7	20.5	26.8	1.1	Underground	7.0	25.2	23.3	17.6	1.1	Underground	9.30				
Export Thermal	6.0	27.5	24.9	11.6	0.3												
Export Thermal	2.9	22.6	21.3	23.9	1.1	Probable						Indicated					
Export Thermal	4.2	27.5	24.5	11.6	0.4	Opencast	11.2	25.5	23.1	16.6	1.1	Opencast	10.92				
Export Thermal	4.8	22.3	20.4	24.7	1.0	Underground	9.9	25.1	23.6	17.8	1.1	Underground	13.09				
Export Thermal	6.1	27.5	25.1	11.6	0.3												
Export Thermal	4.2	22.6	21.9	23.8	1.0												
Total Proved and Probable Saleable Coal Reserves	41.3	25.4	23.2	17.0	0.7	Total Proved and Probable RoM Coal Reserves	43.1	25.4	23.3	17.0	1.1	Total Measured and Indicated Coal Resources	47.92				
												Inferred	4.81				
Total Saleable Reserves	41.3					Total RoM Reserves	43.1					Total Inferred Coal Resources	52.73				

Resources are inclusive of Reserves.

Table 4.18 Ingcambu Project: SRK – Audited Coal Resources and Coal Reserves⁽¹⁾ (at 1 January 2006)

SALEABLE COAL RESERVES										RoM COAL RESERVES				MINEABLE IN-SITU COAL RESOURCES			
Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%)	Ash (%)	S (%)	Category	Tonnage (Mt)	CV (MJ/kg)	Vol (%)	Ash (%)	S (%)	Category	Tonnage (Mt)				
Proved						Opencast						Measured					
Opencast Thermal	0.21	28.04	33.04	9.93	0.83	C Upper	0.21	21.33	20.21	26.88	0.75	Opencast					
Middlings (thermal)	0.17	21.33	20.21	26.88	0.75	C Lower	0.12	23.3	28.41	20.96	1.32	C Upper	0.48				
Export	0.06					Underground						C Lower	0.47				
Underground	0.19	28.1	32.19	12.04	0.82	C Lower	0.37	24.79	29.18	20.34	1.08	Underground	0.54				
Total Proved and Probable Saleable Coal Reserves	0.62					Total Proved and Probable RoM Coal Reserves	0.70					Total Measured and Indicated Coal Resources	1.49				
												Inferred					
												Total Inferred Coal Resources					
Total Saleable Reserves	0.62					Total RoM Reserves	0.70					Total Resources	1.49				

(1) SRK has only included proved and probable reserves. Ingcambu has commenced with mining operations. However, SRK does not have sufficient confidence in the reserves to compile a detailed LoM Plan. SRK has derived a value for Ingcambu based on a truncated LoM Plan.

Resources are inclusive of Reserves.

Table 4.19 Strehla Project – Coal Resources (at 1 January 2006)

MINEABLE IN-SITU COAL RESOURCES

Category	Tonnage (Mt)
Indicated	
Opencast	22.52
Underground	
Total Measured and Indicated Coal Resources	22.52
Inferred	
Total Inferred Coal Resources	
Total Resources	22.52

Table 4.20 Moranbah South Project – Coal Resources (at 1 January 2006)

IN-SITU COAL RESOURCES

Category	Tonnage (Mt)
Indicated	586.4
Total Measured and Indicated Coal Resources	586.4
Inferred	123.7
Total Inferred Coal Resources	123.7
Total Resources	710.1

4.4 Heavy Minerals

4.4.1 Hillendale Mine

The Hillendale Mine deposit consists entirely of Berea Formation red sands; this is consistent with the relative elevation of this dune relative to the present sea-level. The sediments are generally well-sorted and fine to medium grained and also include a significant volume of clays that indicate extensive decalcification and kaolinisation within a tropical weathering environment. Within the Hillendale deposit, silt (– 45µm) proportions range between 15% and 45% and the sand thickness ranges from 3m to 45m; the average thickness is between 18m and 21m.

The footwall of the orebody is defined by falling THM grades. Within the Hillendale dune complex, some variations in sand qualities have been noted within the drillhole data. In the central and northern sector of the Hillendale dune, the western half of the dune contains sporadic occurrences of coarse-grained orange sands characterised by low silt grades. The origin of these sand units remains equivocal and the relationship between these units and the red Berea sands remain unclear. In the central parts of the dune a grey semi-indurated calcic sandstone unit may be developed between 10m and 25m beneath the surface. Beneath the Berea sand, the Hillendale dune complex is underlain by a kaolinitic clay unit that is green to yellow-brown. This unit is interpreted to represent lagoonal muds developed within a low-energy environment landward of the dune complex.

Hillendale deposit was initially sampled during the late 1980s by NMS, who used a power auger to explore the deposit following visual identification of heavy minerals within the Hillendale dune complex. A limited amount of large diameter auger drilling has also been completed in the Hillendale deposit. In addition, continuous-auger drilling has also been undertaken. Reverse-circulation drilling has also been undertaken at Hillendale and comprises the majority of the sample database.

The central portion of the Hillendale deposit has been mined. The southern section of the deposit is predominantly sampled using RC drilling, at a nominal drillhole spacing of 50m by 50m. In July 2004 most of the northern sector, north of the mined block, was re-drilled by Wallis drilling using aircore drilling technology (WAC); this drilling was completed at a nominal drillhole spacing of 50m by 50m. The most northerly sector of the deposit has not been covered by Wallis drilling and remains sampled by RC drillholes. In total, inclusive of grade control drillholes, there are 1,279 drillholes within the Hillendale deposit; 440 of these holes represent NMS and IHM sampling operations consisting of Power Auger (124 holes by NMS), RC (105 holes by NMS and 493 by IHM and Tigor), WAC (409 by Tigor), six core auger holes (IHM) and a set of Large Diameter Auger (LDA) holes (52 by NMS and 90 by IHM).

The geology and mineral resources of the Hillendale deposit is described by three separate block models:

- Area 1 is the northernmost block and Area 3 is the southernmost. Area 1 is the unchanged 2001 vintage model;
- Area 2, the central sector of the deposit that contains most of the Wallis aircore drilling, is covered by a 2004 model; and
- Area 3, which includes the mined-out block, is described by a model of 2003 vintage.

Exploration samples for Hillendale and Fairbreeze Project have been analysed at two laboratories; these are the Old Blen/IHM Laboratory, which was situated at Hillendale; and currently the CPC Laboratory, which has ISO 17025 accreditation for its final product analysis. The analytical process applied to exploration drillhole samples includes a number of consecutive and dependent stages:

Samples are screened at a 1 mm size to remove the oversize component. This process is not part of the initial work recorded at Hillendale and appears to be most specifically undertaken at Fairbreeze Project.

Samples are subject to attrition and then desliming, in which the – 45µm material is screened off and the remaining dried sample mass is determined: this permits the silt mass percentage to be estimated

The heavy mineral content is determined by undertaking a Tetra-bromo-ethane (“TBE”) heavy liquid separation: the material that sinks is recovered and weighed to yield the THM content.

The THM fraction is subjected to magnetic separation within a Carpc Magnetic Separator; initially the high susceptibility magnetics (essentially magnetite) is removed, followed at higher gauss settings by crude ilmenite, the magnetic “others” and the non-magnetic heavy mineral fraction.

Zircon and rutile report to the non-magnetic heavy mineral fraction. Leucoxene may report here, as well as in the magnetic “others” fraction.

For Hillendale, a set of samples was subjected to grain counts on the various magnetic separation concentrates and a set of constant ratios were determined for the non-magnetic fraction mineralogy. The determined proportions of the minerals of interest that were subsequently used were: zircon 56%, rutile 26% and leucoxene 6%.

Rig duplicate samples have been collected for several of the sampling campaigns, typically at a frequency of between 5% and 2% of the total samples, and these data have been used to examine the precision of these data pairs utilising two techniques, namely a modified Thompson-Howarth process and the Absolute Relative Deviation (also known as the Mean Percent Difference). These two methods have been applied to field duplicate data from CPC, Old Blen and IHM Laboratories and these laboratories yield similar results. Additionally the two precision measures also yield convergent results; at the 95% confidence limit, relative precision for THM is of the order of 27%, for Silt, 23%. The precisions for the magnetic separates are significantly higher because errors in the process are cumulative and at each stage in the process smaller masses are considered, so relative errors are expected to increase. Magnetite experiences a precision of $\pm 39\%$, ilmenite $\pm 40\%$, magnetic – “others” $\pm 80\%$ and non-magnetic fraction, $\pm 68\%$.

In addition to monitoring reproducibility, control samples (internal standard samples whose values are not certified) are submitted within exploration samples to attempt to monitor accuracy. Kumba have submitted control samples at a frequency of 4% with routine exploration sample submissions to the laboratory. From laboratory returns for exploration campaigns conducted at Hillendale (2001 – 2002 – CPC Laboratory) and Fairbreeze Project (June – September 2002 – CPC Laboratory) and Fairbreeze Project C (2003 – IMP Laboratory) it is evident that the about 82% of the data fall within 1 standard deviation of the mean value of the control sample. The co-efficient of variation of the standard values and the relative scale of this variation does, however, vary between the different sample programmes. As an example, the 1σ limits in the Fairbreeze Project C exploration programme (CPC Laboratory) for the Ilmenite determinations are $\pm 2.1\%$, whereas the same limits within the Fairbreeze Project C Extension exploration programme (IMP Laboratory) are $\pm 1.2\%$. Analytical results for the Hillendale Ilmenite values at the CPC Laboratory have 1σ limits of $\pm 0.44\%$. These results show that there are significant differences between the Relative Standard Deviations of the determinations undertaken at the two laboratories within the three programmes; the IMP Laboratory programme has the lowest RSD (11%), followed by the CPC Lab results at Hillendale (11.5%) and the CPC Laboratory at Fairbreeze Project C (19%).

Details of quality control data for pre-1995 drill programmes are not available and it is necessary to assume that the analytical quality of previous sampling campaigns probably approximates the present sampling data. Some of the drillhole logs record evidence of duplicate sampling having taken place; however the duplicate results have not been captured electronically and have not been subjected to any systematic analysis that would provide a measure of analytical repeatability for earlier drilling and sampling campaigns. One issue of note, however, concerns a change in the analytical procedures that appears to have taken place in April 2001.

Prior to this date, magnetic separations were undertaken using a current setting of 0.1A for magnetite, 0.5A for ilmenite and 3A for magnetic others/non-magnetics. After 2001 the settings for the magnetic separators were 0.05A for magnetite, 0.8A for ilmenite and 2.4A for magnetic-others and non magnetics. The implications of these changes are unclear, but some variance between older exploration data and newer information may become apparent.

With regard to other data aspects, there have been some issues with respect to drill collar information. Within the Fairbreeze Project data set drill collar locations have either been surveyed or have been scaled-off from orthophotographs. Some of these drillholes had collar elevations that differed from the elevation determined from an airborne laser survey conducted in December 2002. The collar elevations have been 'corrected' according to the DTM. Data requiring a correction of greater than 4m are excluded from all geological modeling processes; data where the collar correction exceeds 2m and the hole was not surveyed, but was scaled from orthophotographs are used in modeling, but not for grade interpolation.

The Hillendale deposit is described by three separate block models. The block size used for modeling is 10m x 10m x 5m. A wireframe surface has generally been created to depict the floor of the mineralisation and this wireframe surface attempts to delineate the sample cut-off grade of 1.5% THM. Crude ilmenite corresponds to approximately 55% of the THM grade. The THM grade cut-off is determined considering the average grade of the last two samples. It is unusual to see a large number of grade 'spikes' beneath the modeled footwall surface to the mineralisation. In some cases, drillholes do terminate in 'ore', particularly some of the older drillholes that might have intercepted more indurated sand zones that retarded the drillhole progress. Modeling of these older holes has given rise to 'high toes' in the modeled footwall within older models of the Hillendale deposit and mining has exposed ore grade materials beneath many of these features. The topography of the Hillendale deposit has been surveyed at a 2m resolution using differential GPS instrumentation to a ± 1 cm accuracy.

The Area 2 Model is informed by Wallis Aircore drillholes at a 50m x 50m drillhole spacing; on the southwestern periphery of the deposit some RC drilling data are retained within the model, which was completed in April 2005. Two separate geological domains have been considered within the Area 2 Model; the western 'core' of the dune complex consists of low-silt coarser-grained sand, which is also characterised by a high proportion of 'magnetic-others' and the remaining volume of red Berea Formation, high silt sands.

Variographic analysis has been undertaken on the two domains and the variogram ranges are used to develop search strategies for the estimation. Estimation has been undertaken using inverse-distance cubed weighting. Grade interpolation takes place in four stages. The first estimate is based on the search ranges derived from the variogram parameters (search ranges of 2/3 variogram ranges) and an octant based search strategy is applied in which a minimum of between 10 and 15 composite samples is required to be located within the search neighbourhood for the block to be estimated.

Blocks that are not estimated with the first search are subject to a second pass estimate in which the search ranges are increased (search ranges are doubled to be equal to 1.5 times the variogram ranges). Blocks that are not estimated using this second search are estimated using a nearest neighbour estimate based on either drillhole samples or the nearest estimated blocks. Blocks are flagged to record which search was used to estimate the block grade, also with the number of samples located within the search procedure.

At present only the Hillendale is in production. Reconciliation work between the block model and the PWP recoveries has been undertaken on a monthly basis over a period of 29 months (January 2003 to May 2005). In general the tonnage values correspond quite well, although there are some large variations between the actual results and the estimates within the model (as large as 25%) on a monthly basis. Since late 2004 the tonnage treated by the PWP divided by the tonnage depleted factor has been close to 1.

For ilmenite the results are quite stable, although over the 29 months, the model has understated the production results by 17% with respect to ilmenite, by 28% for zircon and 22% for rutile. Leucoxene recovered values are on average 220% of the predicted values.

SRK considers that these observed biases within the estimates are highly likely to be a result of the sampling methodology, most specifically the use of reverse circulation drilling. Mining of the area sampled by Wallis aircore drilling includes only the months of March 2005 until May 2005. Indications are that the reconciliation between the model and the production plant may be improving, although the sample is too small to demonstrate this behaviour conclusively.

Rig split duplicates reveal that the total precision associated with the sampling and analytical procedures is actually quite poor for the non-magnetic fraction, but are acceptable for THM and Silt determinations.

Accordingly, the zircon, rutile and leucoxene estimates are expected to be quite poor and this is clearly indicated by the reconciliation data for the Hillendale deposit.

SRK considers that the Mineral Resources are based on an acceptable number of data values, with acceptable quality to permit the classification of Mineral Resources that has been applied by Kumba to this deposit.

Hillendale has drilled off significant sections of the remaining Mineral Resource using Wallis Aircore drilling, which shows better sample recovery than RC drilling that dominates the Mineral Resource database in the current mined out areas. Given the fact that the Wallis Aircore drilling is considered to provide better sample information than the older RC drilling and that the majority of the remaining Hillendale Mineral Resource is drilled off predominantly by Wallis Aircore drilling, SRK has not used any upgrade factors in the preparation of the FM and has used the in-situ ore grades as reported from the Hillendale Mine Surpac block models, against the mine plans provided by Tigor SA to SRK.

4.4.2 Fairbreeze Project

The Fairbreeze Project deposit is divided into five separate blocks: Fairbreeze Project A, B, C, C Extension and D Blocks. Fairbreeze Project deposits consist of Berea formation sands, although at Fairbreeze Project these sands occur on a variable bed-rock surface. In the extreme north, Vryheid Formation rocks (sandstones and shales) crop out southeast of the Fairbreeze Project C deposit. Between the A and B blocks Natal Group lithologies (sandstones and grits) are exposed. In this area, Berea sands are generally absent and the overburden developed above the bedrock consists of fine-grained, silt poor wind blown sands.

The Fairbreeze Project A and B deposits are considered to represent two sections of a set of strandline deposits. Strandlines represent tabular zones of concentrated heavy mineral accumulations that are preserved by gradual marine regression that leaves the strandline above the level of marine erosion.

Fairbreeze Project C deposit has been interpreted to be a beach deposit formed on the low energy side of an ancient headland that projected into the sea. The heavy minerals accumulated against the headland, whilst the lighter minerals were continually remobilised by wind transportation, resulting in concentration of the heavy minerals. Fairbreeze Project D deposit has been interpreted to represent a set of strandlines deposited to the east of Fairbreeze Project A, B and C deposits during progressive sea-level regression. The Fairbreeze Project deposits have been sampled at variable spacings and using a variety of sampling techniques. The initial stages of exploration involved the use of shallow hand auger holes by NMS to undertake a reconnaissance sampling programme over the dune complexes to identify presence of heavy minerals. Mittal Steel continued sampling of the Fairbreeze Project deposits after acquisition of NMS and have made use of auger techniques including power auger, large diameter auger and core auger. Reverse circulation drilling was undertaken at Fairbreeze Project A (at a nominal drillhole spacing of 200m x 200m) and Fairbreeze Project D deposits (15 drillholes).

Substantial areas of the Fairbreeze Project C deposit have also been explored using RC drilling techniques, at a nominal drillhole spacing of 50m x 50m. Wallis aircore drilling has been undertaken at Fairbreeze Project C Extension at a nominal drillhole spacing of 100m x 100m. A limited amount of Wallis aircore drilling has been completed in the Fairbreeze Project A deposit and Fairbreeze Project C deposit, specifically for metallurgical purposes and to gain additional data relating to the mineralogical zoning of the deposit.

This work has been concentrated within the areas planned for initial mining. The Severin Development Corporation did complete some RC drilling within the Fairbreeze Project C Extension deposit; because of uncertainties relating to the position and analytical procedures employed for these holes, Kumba have not retained these earlier data in the Fairbreeze Project C Extension estimation. Fairbreeze Project Mineral Resource estimation has been undertaken within two modeling exercises. SRK were provided with two block models for the purposes of review; one model created in 2002 contained data relating to Fairbreeze Project A, B, C and C Extension deposits. A second model created in 2004 contained estimates for the Fairbreeze Project C and C Extension orebodies.

Staff of Kumba reported that the initial estimation at Fairbreeze Project was undertaken using a block size of 10m x 10m x 5m. The block model has been constrained between a topographic surface and a footwall surface that that was derived from prevailing costs and assumptions relating to an economic grade at the time of the generation of this model. In essence an incremental grade cut-off was applied, that approximates 1.5% ilmenite. In situ grades for THM, silt, ilmenite, magnetic-others and non-magnetics were interpolated using inverse-distance cubed weighting. Given that the drill hole data are located on a grid, SRK are of the opinion that inverse distance-cubed weighting, whilst not preferable to kriging, should give a globally unbiased result.

The deposit was subdivided into two separate domains; estimations were undertaken within an upper zone and a lower zone of the deposit, where a high THM sand unit and a low THM sand unit, respectively, have been identified. Zircon, rutile and leucoxene were determined from abundances of these minerals observed within grain counts performed on composite samples of the non-magnetic heavy mineral fractions.

In 2004 Kumba undertook a re-estimation of the Fairbreeze Project C and Fairbreeze Project C Extension model after completion of additional drilling; in 2002 103 RC drillholes were developed at a nominal drillhole spacing of 50m x 50m within the northern half of the Fairbreeze Project C deposit. Conventional analyses were completed on 3m composite samples. In addition, XRF determinations and mineralogical examinations were completed on composite samples of the crude ilmenite and non-magnetic fractions. The southern half of the deposit is covered with 100m x 300m spaced RC drillholes. In 2003, 157 Wallis aircore drillholes were developed at a nominal spacing of 100m x 100m over the Fairbreeze Project C Extension deposit. Analyses were completed on 3m composites and XRF and mineralogical analyses were undertaken on composite samples of the crude ilmenite concentrates as well as on the non-magnetic fractions of the THM. A 14-hole, large-diameter auger programme was also undertaken during May 2003 on the Fairbreeze Project A, Fairbreeze Project B, Fairbreeze Project C and Fairbreeze Project C Extension to generate samples for pilot plant test work.

Fairbreeze Project C and Fairbreeze Project C Extension deposits were sub-divided into domains on the basis of the THM values and the magnetic-others component within the THM. Variography was undertaken to establish acceptable search criteria. The majority of components examined displayed nested spherical variograms. Values were interpolated using inverse distance cubed estimation with the search ranges equivalent to the ranges of the first structures of the variograms. Blocks that were not estimated in the first search were estimated using a second search, where the search ranges were equivalent with the longer range structures of the variograms. Blocks that were not estimated using these two search procedures were estimated using nearest-neighbour methods.

Silt was examined on a global basis, whilst within the domains the THM and other components were examined. Kumba elected not to use the in-situ values for Ilmenite, and the other components of the THM, but rather to work with the percentage of Ilmenite within the THM value. This approach was then applied to all other components as well. In-situ ilmenite values were recovered by multiplying the THM estimate with the Ilmenite percentage-of-THM estimate. The estimated magnetite, ilmenite, magnetic-others and non-magnetic values were summed and then normalised against the THM estimate, the normalisation factors derived from this process were then applied to each of the estimated components in turn to ensure that the sum of the estimated components is equal to the estimate of the sum. Mineralogical grain counting work was undertaken on selected composite samples of the magnetic separates of the THM concentrates to determine the ratio between leucoxene and rutile. The orebodies were zoned according to these results and the rutile and leucoxene values were determined from factors determined from mineralogical and XRF analyses of the composite samples of the non-magnetic fraction. This total ZrO₂ within the non-magnetic fraction has been assumed to be hosted within zircon and the zircon grades have been determined on this basis.

Surface models were created from the drillhole data, representing cut-off grade isopachs that would effectively define the base of the mineralised orebodies. An isopach surface representing the 1.5% THM boundary defines the bottom of the orebody. Material between this surface and a 1.5% ilmenite surface has been classed as 'low grade material', whilst 'Ore' is classed as material above the 1.5% ilmenite surface model.

The recent sampling (post-2003 in Fairbreeze Project C and Fairbreeze Project C Extension) within portions of the Fairbreeze Project deposit is subject to the same analytical imprecision (particularly with respect to the non-magnetic fraction). Because of the drilling methodology employed in Wallis aircore drilling there is an assumption that data developed from sampling of Wallis aircore holes presents samples that are 'of higher quality' than conventional RC samples.

SRK's experience in Mineral Sands exploration leads to a concurrence with this opinion. SRK consider that the Fairbreeze Project C and C Extension Mineral Resource estimates are based on suitable numbers of acceptable samples.

4.4.3 Limpopo Province – Gravelotte

The Limpopo Province assets were explored and delineated by IHM. The primary orebody consists of alluvial mineralisation that has accumulated above the recent unconformity developed above the Rooiwater Igneous Complex lithologies. Some hard rock mineralisation has been included within the Mineral Resource as well.

Cut lines were developed at a 200m spacing over the project area and detailed mapping was carried out along the cutlines. Some diamond drilling was undertaken; two holes were drilled on each section line spaced 400m apart, except on the Farm Quaqua 759LT, where the drill sections are located 800m apart on strike. The sand unit was sampled within pits that were dug at 50m spacings along the 200m spaced cut-lines. The samples were analysed at Mittal Steel Laboratories (SANAS accredited, registration number TO165) and the ilmenite

content of the samples includes all ilmenite, even that material with a grain size of less than 45µm; approximately 14% of the total ilmenite is located within the fines component of the orebody. No quality control data are available to demonstrate the appropriateness of the sub-sampling techniques or the resultant sample grade values that are included within the Mineral Resource estimate. An in situ density value of 1.75t.m⁻³ has been derived from testwork conducted in the sand mineralisation, using a sand replacement method.

The pebble and hard rock mineralisation has been explored using diamond drilling techniques and 1m downhole sampling intervals were employed. Half core samples were analysed by whole rock XRF methods. The 50m x 200m data grid confirms the relatively uniform grade and thicknesses of the Gravelotte Sand resources, and testwork reported by Shepherd (1996) suggests that similar estimation results are accessible from subsets of the drillhole and trench sampling data.

The Gravelotte Sand resource has been estimated within the Surpac modeling software, using inverse distance cubed estimation. Depth and percentage TiO₂ have been interpolated into a two-dimensional grid model with blocks of 200m x 50m. Michael Shepherd (1996) reports the comparison between the Mittal Steel Mineral Resource estimate for the Begin property within the Gravelotte Resource and his own independent estimate conducted on the Mittal Steel data; there is a favourable comparison.

The analytical technique used and the subsequent estimation method applied in the Gravelotte Sands deposits accounts for all ilmenite, including the fines material that would not normally be recovered using a sand-type circuit. In many instances early removal of the fines is preferable to enhance the efficiency of gravity concentration equipment. Mittal Steel have modeled the exclusion of this component of the Resource within their feasibility study work completed on the Gravelotte deposits.

The Gravelotte Resource and Reserve Statement is SAMREC compliant.

4.4.4 Eastern Cape Deposits

The Eastern Cape deposits consist of Pleistocene age sands. There are four principal heavy mineral deposits; Sandy Point Old, Sandy Point Recent, Wavecrest and Kobonqaba. The Sandy Point Old, Wavecrest and Kobonqaba deposits consist of a belt of undulating fixed dunes aligned parallel to the coast and are typically 4km to 5km wide and up to 80m thick. They are considered to be aeolian in origin. The Sandy Point Recent deposit consists of younger dunes and beach sands, which occur as a belt of light, coloured sand separating the older fixed dunes from the sea. This second setting has a lower silt content, 4% compared to 20%, as weathering has been less prolonged. THM content varies between 5.8% and 9.5% with a valuable fraction of 62% to 82%.

4.4.5 Ticor SA Resource and Reserve Statements

Table 4.21 lists the audited Mineral Resources estimates for the Ticor SA deposits as per 1 January 2006. Fairbreeze A and B, classified as Reserves, are valued as exploration properties and therefore not included in Table 4.21. SRK is of the opinion that sufficient work has been done on these resources to demonstrate that the resources can be profitably mined and recovered in the future. Ticor SA intends to undertake a Definitive Feasibility Study (“DFS”) on the mining of the Fairbreeze Project A and Fairbreeze Project B deposits in the medium term future. The Gravelotte and Letsitele deposits are also included in the Table 4.2.1.

Table 4.21 Tigor SA: SRK – Audited Resources and Reserves (at 1 January 2006)

	MINERAL RESERVE CATEGORY					MINERAL RESOURCE CATEGORY						
	Total Heavy Minerals Tonnage (Mt)	Ilmenite ⁽⁴⁾ (%)	Silt ⁽⁴⁾ (%)	Zircon ^{(1),(4)} (%)	Rutile ^{(1),(4)} (%)	Leuco-xene ^{(1),(4)} (%)	Total Heavy Minerals Tonnage (Mt)	Ilmenite ⁽⁴⁾ (%)	Silt ⁽⁴⁾ (%)	Zircon ^{(1),(4)} (%)	Rutile ^{(1),(4)} (%)	Leuco-xene ^{(1),(4)} (%)
Proved												
Hillendale	30.7	6.8	4.1	25.7	0.5	0.2	30.8	6.8	4.1	25.7	0.54	0.11
Fairbreeze C	17.7	11.7	7.3	28.8	1.0	0.4	12.0	5.8	2.5	22.2	0.31	0.03
Probable							4.3	4.7	2.9	26.8	0.33	0.04
Fairbreeze C Extension	25.6	9.4	6.2	27.8	0.8	0.3	139.8	4.8	2.8	31.4	0.39	0.08
Total Proved and Probable	74.0	8.8	5.6	27.2	0.7	0.3	18.0	11.6	7.3	28.9	0.96	0.16
Resources are inclusive of Reserves.												
							44.2	7.7	5.0	27.1	0.63	0.15
							52.4	13.0	11.0	38.0		
							22.7	5.5	4.6	38.0		
							12.5	12.4	10.5	38.0		
							232.9	6.9	4.5	18.4	0.40	0.25
Indicated												
Fairbreeze B	26.9	5.0	2.4	32.6	0.16	0.10						
Fairbreeze D	9.2	4.6	2.5	28.2	0.13	0.06						
Block P	40.6	5.1	3.1	24.7	0.51	0.23						
Leitsitele Rock	53.6	25.9										
Total Measured and Indicated	699.8	8.4	6.3	24.3	0.18	0.04						
Inferred												
Gravelotte Pebble ⁽³⁾	31.3	4.7	4.0	15.9								
Gravelotte Rock ⁽³⁾	112.3	20.7	20.7	–								
Total Inferred	143.6	17.2	17.1	3.5								
Total Measured, Indicated and Inferred	843.4	9.9	8.1	20.8	0.15	0.03						

- (1) With the exception of Fairbreeze C, Fairbreeze C Extension and Hillendale Zircon, Rutile and Leucoxene grades are considered to be an indicated category for all resources.
- (2) Resources that are modified to produce reserves.
- (3) Resources that are not modified to produce reserves.
- (4) Component of tonnage.

4.4.6 Ticor

In general Resources and Reserves are classified using a combination of drillhole spacing and knowledge of the geological continuity, assisted by variography. A particular drill hole spacing alone does not define a classification. A typical drill spacing for Measured Resources across strike is 20m with 10m edge definition. Along strike spacing for Measured resources can vary considerably and can be up to 200m depending in the continuity of the HM grades.

SRK has concerns regarding the lack of quality assurance procedures for classification of Resources and Reserves, however reconciliation studies show that overall the HM tonnages predicted by the models are within 3% of the production tonnages.

Head grade: Grade factors of approximately +10% for HM and +16% for Valuable Heavy Minerals ("VHM") are used for production forecasting and long term planning. The reason for the HM grade discrepancy is not well understood by Tiwest JV but is thought to be in the assaying process rather than the block estimation procedures. SRK supports this view. Tonnage factors are also in use for production forecasting. Reconciliation data from nine months of 2005 shows production figures for HM tonnes exceed the block model Reserves by 2.9% and VHM tonnes exceed the block model Reserves by 8% inclusive of dilution and losses.

Ore Loss and Dilution: Floor and top of ore are surveyed and analysed on a monthly basis against block model and production data. Current monthly reconciliation is attempting to quantify some of the actual dilution and mining loss parameters. SRK calculations from nine months of reconciliation data show that the combined effect of dilution and losses results in a 2.6% loss of HM tonnes and a 2.6% loss of VHM tonnes across the North and South mines combined when compared to the original reserves.

Resource and Reserve Inventory: The planning 'reserves' are essentially Resource material with an allowance for dilution within 'conceptual pits' allocated to a long-term schedule.

Table 4.22 Ticor: SRK – Audited Resources and Reserves (at 1 January 2006)⁽¹⁾

MINERAL RESERVE CATEGORY		MINERAL RESOURCE CATEGORY												
	Tonnage (Mt)	Total Heavy Minerals		Ilmenite ⁽²⁾ (%)	Rutile ⁽²⁾ (%)	Zircon ⁽²⁾ (%)	Leuco-xene ⁽²⁾ (%)	Tonnage (Mt)	Total Heavy Minerals		Ilmenite ⁽²⁾ (%)	Rutile ⁽²⁾ (%)	Zircon ⁽²⁾ (%)	Leuco-xene ⁽²⁾ (%)
		(%)	(%)						(%)	(%)				
Proved								Measured						
Cooljarloo	25	3.7	60	4.8	10	2.7		Cooljarloo	157	2.7	61	4.5	10	3.1
								Jurien						
								Dongara	1.3	6.9	51	9	15	1.5
Probable								Indicated						
Cooljarloo	378.9	2.3	61	4.5	10	3.3		Cooljarloo	302	2.4	61	4.9	10	3.1
Jurien	16.6	7.7	54	6.8	10	2.3		Jurien	25.6	6	53	6.9	10	2.2
Dongara	21.3	9.8	50	6.7	9	1.3		Dongara	75	6.7	49	7	10	2
Total Proved and Probable	441.8	3.0	59	5.1	10	2.9		Total Measured and Indicated	560.9	3.2	57	5.6	10	2.7
Resources are inclusive of Reserves.														
								Inferred						
								Cooljarloo	25	1.8	60	5.4	12	4.1
								Total Inferred	25	1.8	60	5.4	12	4.1
								Total Measured, Indicated and Inferred	585.9	3.2	57	5.6	10	2.7

(1) SRK has audited the January 2005 Resources and Reserves for Cooljarloo, Jurien and Dongara. SRK has not recalculated Resource and Reserve estimates. SRK has however undertaken sufficient check calculations and reviews of procedures to be satisfied that there are no material issues that would seriously alter the Resources and Reserves quoted by Twest JV in their January 2005 Resource and Reserve statement (and reprinted here). SRK are satisfied that the January 2005 Resource and Reserve are JORC and SAMREC compliant. SRK has not audited the December 2005 Resource and Reserve.

(2) Component of Total Heavy Minerals.

Table 4.23 Heavy Minerals: Mineral Resource Estimate (at 1 January 2006)⁽¹⁾

Mineral Resource Category	Tonnage (Mt)	Total Heavy Minerals			
		(%)	Ilmenite ⁽³⁾ (%)	Zircon ⁽³⁾ (%)	Rutile ⁽³⁾ (%)
Indicated					
Kobonqaba	85.38	5.8%	4.2%	0.4%	0.2%
Sandy Point Old ⁽²⁾	34.21	9.5%	5.5%	0.5%	0.3%
Sandy Point Recent	34.63	9.5%	5.6%	0.5%	0.3%
Wavecrest	78.72	5.8%	3.9%	0.4%	0.2%
Total	232.94	6.9%	4.5%	0.4%	0.2%

(1) Leucoxene grades were not determined for the above properties.

(2) The new order prospecting right application was submitted on 30/08/2005 to renew the old order prospecting permit No. 3/2000 PP (expiry date 17/09/2005). The application is still being studied by the DME. Ticor SA was asked by the DME not to conduct any work while a cost benefit study was undertaken. The result of this directive is that no exploration work could be conducted until a another instruction is issued by the DME.

(3) Component of Tonnage.

4.5 Base Metals

4.5.1 Rosh Pinah

Drilling at Rosh Pinah is divided into primary, secondary and tertiary phases. The primary and secondary drilling are exploration drilling used to find and broadly delineate the orebodies. The tertiary drilling is used to more accurately define the limits of the orebody for production planning and to obtain closely spaced grade information for estimation purposes.

The exploration drilling at Rosh Pinah is predominantly conducted from underground exploration drives developed alongside the orebody, or the expected position of the orebody. The primary drilling is conducted on a 60m grid and the secondary drilling on a 30m infill grid. The tertiary drilling is drilled from production drives within the orebody and from access tunnels near the orebody and attempts to obtain a 10m grid of pierce points through the margins of the orebody limits, as well as creating a grid of grade values within the orebody. Since the geometry, width and shape of the orebodies are highly irregular, it is not always possible to conform to a precise grid and thus the drilling can better be described as 60m-, 30m- and 10m-spaced pierce points drilled perpendicular to orebody attitude. Surface drilling is also conducted at Rosh Pinah. Over the history of the mine, there has been a total of over 400,000m drilled. Of that, approximately 100,000m was drilled from surface, 184,000m from underground as primary and secondary exploration and 120,000m as tertiary production drilling.

All underground drilling is currently with BQ sized diamond drill core (42.1mm). However in the past some NQ (54.8mm) sized core was drilled, predominantly from surface to gain the maximum benefit from oriented core and structural information. Core recoveries are recorded on the log sheets and are generally reported to be in excess of 95%. Some reverse air blast drilling has also been conducted in the past on soil covered plains to determine bedrock lithology and obtain a rock chip sample. Secondary underground boreholes that are less than 100m in length have co-ordinate positions calculated according to surveyed collar dips and azimuths; all boreholes over 100m in length are surveyed using down-hole survey equipment. All the holes are electronically logged and photographed for lithological and structural information before being sampled. Samples are taken across any mineralised area. The maximum length of a sample is 1.5m with a minimum length of 40cm. Samples are not taken across lithological boundaries and a 1.5m waste envelope is sampled beyond the interpreted extent of the mineralised zone. The exploration drill core is halved with a diamond saw for sampling while the entire core is sampled for the tertiary drilling. The drilling and assay results are stored in a database, using acQuire software as a front end. The software has a number of validation procedures that insure integrity of the input information in terms of duplicate entries, overlaps and gaps in the drillhole information. Historical drillhole information that has been added to the acQuire database is also in the process of being checked and verified.

Samples are bagged and sent to the on-mine assay laboratory for analysis. Since Rosh Pinah is a Nambian mine, its laboratory does not fall under the ambit of SANAS. The laboratory also does not comply with an ISO accreditation. However, the mine has been operational since 1970 and the on-mine assay laboratory has provided a reliable service in this time.

At the laboratory, the core is crushed with a jaw crusher and then split with a Jones riffle. SRK did not observe the sample preparation in progress, but did however see the discards from the riffle splitter. Some of the material was, in certain dimensions, wider than the 'slots' in the riffle splitter. The distribution of metal within the ore at Rosh Pinah is quite heterogeneous and coarse material such as this can lead to significant bias. The 'slots' in the riffle were also unevenly sized, and had a different number of slots for the two sides, which can lead to a bias in the splitting. There is a secondary crusher available at the sample preparation site which is apparently currently not in use. Comminution to a smaller size would significantly reduce the potential for the process to introduce bias to the preparation procedure. The selection from the riffle splitter is then milled in a rotary puck mill to <math><45\mu\text{m}</math>, and laid out on a sheet, where several random scoops are taken to be composited for analysis.

A 0.1g aliquot of the pulp is dissolved in Aqua Regia (a mixture of Nitric Acid (HNO_3) and Hydrochloric Acid ("HCl"), filtered and then analysed by Atomic Absorption Spectrometry ("AAS"). Total zinc, lead, copper, Fe and Mg concentration are determined and sulphide zinc and lead are derived from the difference of oxide from the total. Recently the Mine Laboratory has acquired an Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES) which is currently being used in conjunction with the AAS for the zinc and lead assays. The reject pulps are returned to the geology department for reference.

The geology department does not submit any independent control samples, however the laboratory analyses a standard sample and a blank sample at the start of every batch. After every 10 samples, the blank and the standard sample as well as the first sample in the batch are repeated. On a monthly basis metallurgical samples are exchanged with two other laboratories (SGS and Industrial Analytical) to verify the accuracy of the results; 132 sample assays have been repeated at Anglo American Research Laboratories ("AARL") in South Africa. The Rosh Pinah results tended to be lower than the AARL analyses. Individual orebodies are defined to constrain grade estimation to the defined mineralised horizons by developing outlines of the orebodies on sections based on the drillhole intersections. The primary data used from the drill holes to derive these outlines are the metal grades. A cut-off of 4% combined zinc and lead is used for the ore outline definition. In addition, outlines of several lithologies within the mineralised envelope are defined. In most areas vertical sections are used primarily to define the outlines, with plan sections used as controls between the vertical sections, with the exception of the A Mine and Eastern Ore Field ("EOF") where plan views are the primary definition, and the vertical sections are used as controls because the orebodies plunge very steeply. Wireframe models are created for each of the lithologies within the mineralised envelope by joining each of the outlines on each section together. The wireframes are used to create block models for each orebody, with cell dimensions of 5m x 5m x 5m, and to assign each block with a 'percent in ore' value. An average Relative Density ("RD") of 3.0 t/m^3 is assigned to all the orebodies with the exception of the EOF, which is allocated a RD of 3.46 t/m^3 . The higher average RD used for the EOF is based on the higher average metal grades found in the EOF, and a set of approximately 3,000 relative density measurements which averaged at 3.46 t/m^3 for the EOF, and 3.0 t/m^3 for the remaining orebodies. The drillholes are composited over 1.5m lengths from the collar. Unsampled intervals that occur within the orebody are assigned a zero value. Anisotropic semi-variograms are calculated for each orebody and where applicable to sub-divided domains within the individual orebodies. The directions of the longest ranges are determined from contour plots of the variograms.

The Rosh Pinah Resource and Reserve Statement is SAMREC compliant.

Table 4.24 Rosh Pinah: SRK – Audited Resources and Reserves (at 1 January 2006)

	Mineral Resource Category									
	Mineral Reserve Category					Mineral Resource Category				
	Tonnage (Mt)	Grade zinc (%)	Grade lead (%)	Tonnes zinc	Tonnes lead	Tonnage (Mt)	Grade zinc (%)	Grade lead (%)	Tonnes zinc	Tonnes lead
Proved	2.71	11.1	2.42	300,347	65,402	3.52	10.07	1.86	354,790	80,274
Probable	0.74	7.72	2.32	45,881	13,125	2.31	8.05	2.59	186,521	59,949
Total	3.45	10.38	2.40	346,228	78,527	5.83	9.27	2.15	541,311	140,223
Resources are inclusive of Reserves.						Inferred	8.77	2.40	95,532	25,323
						Total	6.88	2.19	636,843	165,546

(1) The large difference between Indicated Resources and Probable Reserves is due to the selection of the Manage to Closure option for financial valuation purposes.

4.6 Industrial Minerals

4.6.1 Glen Douglas

Glen Douglas Mine's resource estimation process is based on 144 drill holes representing 5,300m at a nominal spacing of 200m by 200m. The majority of the drill holes were drilled by diamond drilling techniques; however some of the later infill drilling was completed with percussion drilling. Drill holes are sampled every 1m down the hole and the entire core is sampled. The samples were initially only analysed for SiO₂ and total insoluble content, however after the initial exploration, the standard procedure was changed to XRF analysis for Si, Al, Fe, Ca, Mg, Na, K, Mn and Ti. The number and spacing of holes used to define this deposit are considered appropriate given the relatively simple geological structure. In SRK's opinion the quality and quantity of the data upon which the Mineral Resources at Glen Douglas Mine are based is sufficient to derive the Mineral Resources and Mineral Reserves as reported here.

A 3D model of the lithological contacts of the deposit is produced based on modelling drillhole sections 150m apart. These Sections are linked up in geological modelling software to create wireframe models for each lithology. A block model is created in the geological modelling software with block dimensions in the X, Y and Z dimensions of 25, 25, and 10m, respectively. The block model was sub-celled three times in the X and Y direction and twice in the Z dimension using the wireframes, to more correctly represent the volumes of the wireframe solids. Lithological codes are assigned to the block model based on the wireframes solids. Blocks that did not have a lithological code after the initial assignment were populated with lithology codes using inverse distance squared based on the block model cells. The waste and intrusive lithologies are assigned after the dolomite lithology to ensure that no waste is classified as ore. The model is restricted using a surface representing the natural ground surface and the latest pit shell. Vertical sections were created at intervals through the deposit, to check and validate the correlation of the block model, the wireframe solids and the borehole information. Volumes within the block model were also validated against the volumes of the wireframes.

Three-metre composites were created for all the drillholes within the dolomite lithology. Experimental semi-variograms are calculated from these data and a two structured isotropic spherical model created for the semi-variogram. Grade interpolation is carried out using Ordinary Kriging for SiO₂ values using only assay values for the dolomite lithology. SiO₂ is the only variable estimated, as it is the only parameter that impacts the acceptability of the product for metallurgical uses. In-situ densities of 2.83t/m³ for dolomite, 2.89t/m³ for the syenodiorite sill and 1.90t/m³ for soil are globally applied. SRK considers the grade and tonnage estimation methodology applied at Glen Douglas Mine to be suitable for the derivation of Mineral Resources and subsequently Mineral Reserves.

Glen Douglas Mine currently reports Measured Mineral Resources as the potentially metallurgical grade dolomite within a perimeter defined by the drillholes. The remainder of the potentially metallurgical grade dolomite on the property is reported as Inferred Mineral Resources. In its audited resource statement, SRK has classified that portion of dolomite exclusive of a 100m safety pillar, which accounts for the majority of the Mineral Resource classified by Kumba as inferred, as an Indicated Mineral Resource. A portion of the Measured Mineral Resources underlies the process plant and other infrastructure. SRK considers that this material is potentially economically exploitable to produce metallurgical grade dolomite and aggregate, however it is not included in the LoM Plan.

Soil filled cavities, resulting from weathering, occur in the dolomite at Glen Douglas. Despite experiments with a number of different techniques no reliable method has been found for predicting the location of the cavities. When a mining block containing such a cavity is blasted the soil contaminates a portion of the block, rendering it waste and reducing the product yield of the block. Since this is weathering related the incidence of the soil cavities reduces with depth below surface.

Yield estimates have been produced for each bench based on mining records, and these are applied to the block model. The yield values used are in Table 4.25.

Table 4.25 Glen Douglas: Yield Factors and Densities

Bands	Metallurgical			Metallurgical			Average
	Stone	Dolomite	Mixed	Stone	Dolomite	Mixed	
Density (m ³)	2.6	2.6	2.6	2.83	2.83	2.83	2.715
1465	65.0%	65.0%	80.0%	35.0%	35.0%	20.0%	<3%
1455	38.0%	36.0%	70.0%	64.0%	64.0%	30.0%	7.5%
1445	38.0%	33.0%	60.0%	67.0%	67.0%	40.0%	57.0%
1435	38.0%	38.0%	50.0%	74.0%	74.0%	50.0%	74.0%
1425	19.0%	19.0%		81.0%	81.0%		82.0%
1415	10.0%	10.0%		90.0%	90.0%		89.0%

The LoM schedule which defines the Mineral Reserve is defined by the current final pit design to 1,395m. The primary product is metallurgical dolomite, therefore the pit design has been developed around the need to meet this requirement. There is a shortfall in the available tonnage of aggregate. This is not seen as a serious problem as there are a number of options available to meet the requirement. These are:

- Divert a portion of the metallurgical dolomite to aggregate.
- Recover material from the waste dumps by screening out contaminating soil.
- Modify the pit design to mine further into the footwall.
- Increase the depth of the pit into the footwall.
- Mine selectively in the vicinity of dykes and sills to reduce the mining losses.

The first option is not considered a good one as it results in a high value product being sold for a lower price, however the other options are viable and screening is already being used, but the recovered material is not included in the LoM.

The waste associated with this schedule is 18.5Mt of internal waste and 52.4Mt of overburden, dyke, sills and mixed waste, a total of 70.9Mt.

The mine plan assumes mining down to the 1,395m Level. All Mineral Resources used for conversion to Mineral Reserves are classified as Indicated and therefore convert to Probable Reserves.

Total tonnage of Metallurgical Dolomite available is therefore 50.4Mt which at a planned mining rate of 766Ktpa adequately caters for the 30-year life. Total tonnage of Aggregate is 18.1Mt which at a planned mining rate of 723Ktpa allows for a mining life of 25 years. SRK assumes for the purpose of the FM that in the last five years of the LoM Plan the Aggregate is sourced from other sources that may include Metallurgical Dolomite Reserves.

Table 4.26 Glen Douglas Mine: Mineral Resource and Reserves Statement (at 1 January 2006)

Mineral Reserve Category				Mineral Resource Category	
	SiO ₂ %	Saleable Product (Mt)	RoM (Mt)		Tonnes (Mt)
Proved				Measured⁽¹⁾	
Metallurgical Dolomite	<2.5	20.1	20.7	Metallurgical Dolomite	142.3
Aggregate	>2.5	21.6	22.2	Aggregate	40.1
Agricultural Lime		1.4	1.4	Sub-total	182.4
Total		43.1	44.4	Inferred	
Resources are inclusive of Reserves.				Metallurgical Dolomite	163.9
				Aggregate	145.1
				Sub-total	309.0
				Total	491.4