Goldfields.com

Technical Report – National Instrument 43-101

South Deep Gold Mine

South Africa

Effective Date: 31 December 2021

Prepared by Gold Fields Limited

Qualified Person	Company	Date of Signing
Dr Julian Verbeek FAusIMM	**Gold Fields**	30 June 2022
Richard Butcher FAusIMM (CP)	**Gold Fields**	30 June 2022

Table of Contents

List of Tables

List of Figures

1 Summary

This Technical Report was prepared for Gold Fields Limited (Gold Fields, the Company or the Issuer) in accordance with the requirements of National Instrument 43-101 Standards of Disclosure for Mineral Projects (NI 43-101) of the Canadian Securities Administrators, in relation to the South Deep Gold Mine (South Deep) a production stage property in South Africa.

This Technical Report has been prepared for purposes of applicable Canadian securities laws (i) to support the scientific and technical information concerning the project which will be contained or in the management information circular of Yamana Gold Inc. (Yamana) for the special meeting of Yamana's shareholders to be held to approve the proposed acquisition by Gold Fields of all the issued and outstanding shares of Yamana pursuant to a plan of arrangement under the *Canada Business Corporations Act* (the Arrangement), and (ii) in connection with Gold Fields becoming a "reporting issuer" upon completion of that Arrangement for purposes of applicable securities laws in each of the provinces and territories of Canada.

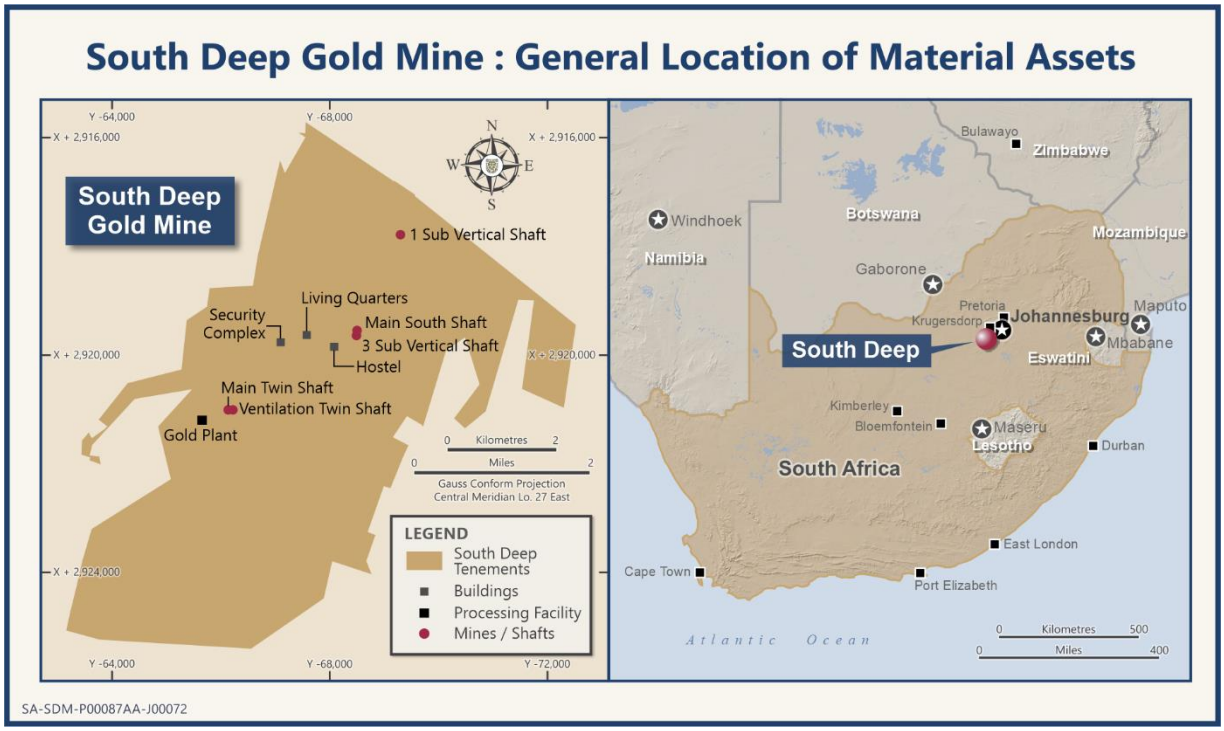
The effective date of this Technical Report is 31 December 2021. This Technical Report does not purport to reflect new information regarding the project arising after such date

Unless otherwise specified, all units of currency are in United States Dollars ($). All measurements are metric except for troy ounces (oz).

1.1 Property description and ownership

South Deep is located approximately 45 km southwest of Johannesburg in South Africa (Figure 1.1).

Figure 1.1: Location of South Deep in South Africa



Source: South Deep CPR, 2021

Newshelf 899 (Pty) Limited holds a 100 % interest in the property. Newshelf is a 90.495 % owned subsidiary of Gold Fields with the remaining 9.505 % held by outside shareholders as part of the legislated black economic empowerment (BEE) policy described in the South African Mining Charter and under associated legislation of the South African

Mineral and Petroleum Resources Development Act 28 of 2002, as amended (MPRDA). For more detail on ownership refer to Item 4.4.

The major components of the South Deep mining and processing operation are:

- The operating South Deep underground mine accessed by two shaft complexes (Twin Shaft and South Shaft).
- Ore handling facilities.
- A carbon-in-pulp (CIP) process plant with a name plate capacity of 4.0 Mt per annum, however, the full capacity is not required for the life of mine Mineral Reserve.
- Tailings storage facilities (TSF).
- Tailings retreatment section with thickener and dedicated Carbon-in-leach (CIL) circuit.
- Refrigeration and ventilation facilities.
- Equipment maintenance workshops.
- Backfill facilities.
- General infrastructure for organisational requirements.
- Administration centres.
- Training facilities.
- Health facilities.
- Residential accommodation with amenities.

1.2 Geology and mineralisation

South Deep lies at the north-western edge of the Archean Witwatersrand Basin of South Africa within the West Rand Goldfield. Gold mineralisation occurs within uraniferous quartz pebble conglomerate horizons, termed reefs. The reefs are generally less than 2 m in thickness and are widely considered to represent laterally extensive braided fluvial deposits or unconfined flow deposits which formed along the flanks of alluvial fan systems or deltas. All major reef units are developed above stratigraphic unconformity surfaces.

The Upper Elsburg formation conglomerates constitute the target economic horizon at South Deep and constitute 100 per cent of the South Deep Mineral Reserve ounces. The Upper Elsburg conglomerates subcrop or truncate below the Ventersdorp Contact Reef (VCR) in a north-north-west trend and are anomalous with respect to the other Witwatersrand reefs as they comprise multiple stacked reef horizons forming an easterly-divergent massive clastic wedge which attains a maximum thickness of approximately 120 m to 130 m in the vicinity of the eastern boundary of the mining right area. In the western half of the South Deep mining right, the VCR occurs as a single reef horizon that overlies the Turffontein Subgroup and is covered by the Ventersdorp lavas and the VCR contributes to the Mineral Resource only at this juncture.

The gold is deemed primarily of detrital origin, deposited syngenetically with the conglomerates. Although the gold generally occurs in native form and is usually associated with pyrite and carbon, most of it is interpreted to have been subsequently modified and remobilized on a very localized scale by secondary hydrothermal processes.

1.3 Exploration, development and operations

South Deep is a deep-level underground bulk mechanised mine exploiting the shallow dipping Upper Elsburg clastic wedge, rendering it unique in its pioneering mining methods, using an owner mining workforce. Mineral Reserves are accessed through de-stress and shadow development cuts to manage rock stress and seismic activity. A number of selective mining methods, including drifts and benches, are employed but long-hole stoping (LHS) with paste fill is the primary bulk mining method. Mining method and extraction sequencing has evolved through various stages in recent years and optimisation is ongoing.

The South Deep mine is accessed from the surface through two shaft systems: the Twin Shafts Complex of which the main shaft comprises a single drop to a depth of 2,998 m below surface, the Ventilation Shaft to a depth of 2,947 m below surface and the South Shaft Complex, which is a subvertical system (three operating shafts) to a depth of 2,786 m below surface.

The South Deep mine is divided into three main areas:

- Current Mine (CM) characterised by selective mining methods scattered over a large area originally exploited by conventional tabular mining. The CM is accessed on four active levels from both the Twin Shaft and South Shaft complexes.
- North of Wrench (NoW) directly south and down dip of CM, comprising six mining corridors separated by regional pillars that extend southwards to the Wrench Fault. This area is largely unmined with a bulk non-selective mining method to be applied.
- South of Wrench (SoW) east and west areas situated south and down dip of NoW to be mined in the same manner as NoW. Access to the SoW blocks requires significant capital infrastructure development.

The recent production performance of South Deep is summarised in Table 15.1.

The Mineral Resource base is predominantly classified as Measured and Indicated, with ~25 % in the Inferred category. With the surface drilling exploration program completed by Gold Fields in 2013 and subsequently integrated with the results of the 3D seismic survey undertaken in 2004, drilling is now focused on resource development and mine definition as opposed to brownfield exploration. Reprocessing of the 3D seismic data was undertaken in 2020-2021 and is being incorporated into ongoing resource model updates. In time, it will be integrated with the ongoing long-inclined borehole (LIB) drilling program focused on the SoW area to further enhance orebody confidence. The LIB program is being conducted in two phases with the aim of constraining the area to a 300 m grid. The first phase is targeting the Wrench Fault and 300 m beyond the fault with expected completion circa 2025. The second phase will follow to the south of Phase 1 also targeting completion of a 300 m drillhole grid. Two diamond drill rigs are currently deployed targeting the western and eastern extents of the SoW area. Drilled LIB metres for 2021 were 3,117 m with a plan for 5,000 m in 2022.

The mine's drilling strategy and standard operating procedure aims to profile the appropriate resource confidence level to support and de-risk the short, medium and long-term mine design and schedules. Three distinct drilling programs are employed, namely:

- Resource definition drilling provides information for medium-term planning and design refinement, and is based on a 60 m – 120 m grid, up to 300 m ahead of the advancing faces. The drilling is conducted from footwall infrastructure and executed ahead of the advancing de-stress cut mining front.
- The LIB drilling attains a 300 m grid, up to 1,000 m ahead of the de-stress mining front. This drilling provides additional data for structural definition, stratigraphic modelling, facies determination and assaying for grade estimation in support of life of mine planning.
- Infill grade control (GC) drilling, termed 'mine definition drilling' on-site, is the final phase of drilling and data acquisition prior to stoping. Underground channel sampling is not undertaken because of safety, access, logistical constraints and spatial control due to the massive nature of the orebody. The drilling program provides the infill drilling to the existing Mineral Resources definition drill grid to achieve an approximate 30 m x 30 m coverage to support final production planning and long-hole stoping. The data generated is used for local scale facies determination, structural definition, stratigraphic modelling, assaying for resource estimation and detailed stope design. Cover drilling is conducted simultaneously which comprises a series of low inclined cover holes (-30 ° inclination) from within the de-stress cut to enhance detail on geological structure. Up to four holes are drilled per corridor up to a depth of 100 m ahead of the advancing cut, and will facilitate a series of in-hole geophysical surveys for increased geological confidence, and for geotechnical modelling and domaining purposes.

Due to its depth, seismicity remains a constraint and a key consideration in mine design and execution. The medium and longer-term control programs are designed to manage the risk and enhancements, including face support pre-conditioning, improved pillar design, layout protocols and extraction sequencing, are all proving to be effective.

South Deep's production ramp-up plan is based on increased stoping output from mechanised de-stress areas, together with continuous improvements in equipment productivities. In 2020-2021 the mine demonstrated that the productivity rates embedded in the life of mine plan are achievable and good progress was made with developing the infrastructure for the new de-stress cuts.

1.4 Mineral Resource estimates

The South Deep Mineral Resources exclusive of Mineral Reserves as at 31 December 2021 are summarised in Table 1.1. The Mineral Resources are 90.495 % attributable to Gold Fields and are net of production depletion up to 31 December 2021. The point of reference for the Mineral Resources is in situ over a minimum mining width with dilution applied.

Table 1.1: South Deep - summary of attributable gold Mineral Resources as at 31 December 2021 (fiscal year end) based on a gold price of $1,500/oz

	Mineral Resources (exclusive of Mineral Reserves)			Cut-off grades (g/t Au)	Metallurgical recovery (%)
	Tonnes/ (kt)	Grades/ (g/t Au)	Gold (koz Au)		
Underground (UG) Mineral resources					
UG Measured Mineral Resources	14,886	6.8	3,236	3.4 to 6.0	96.5
UG Indicated Mineral Resources	69,513	6.5	14,605	3.4 to 6.0	96.5
UG Measured + Indicated Mineral Resources	84,399	6.6	17,840	3.4 to 6.0	96.5
UG Inferred Mineral Resources	20,419	9.1	5,974	3.4 to 6.0	96.5
Surface Mineral Resources (Tailings)					
Tailings Measured Mineral Resources	44,827	0.23	327	0.2	47
Total South Deep Mineral Resources					
Total Measured Mineral Resources	59,713	1.9	3,562	0.2 - 6.0	47 -96.5
Total Indicated Mineral Resources	69,513	6.5	14,605	3.4 – 6.0	96.5
Total Measured + Indicated Mineral Resources	129,226	4.5	18,167	0.2 - 6.0	96.5
Total Inferred Mineral Resources	20,419	9.1	5,975	0.2 - 6.0	96.5

Notes:

a) Mineral Resources are exclusive of Mineral Reserves. Rounding of figures may result in minor computational discrepancies.

b) Surface Mineral Resources are stockpiles contained within historic tailings storage facilities. This material is remined to manufacture hydraulic backfill to support underground mined voids and the gold recovered by a dedicated CIL circuit, is effectively a by-product of the backfill process and is subsidized in the cost model as it pre-empts the need to source new material for this purpose. Importantly, the TSF Measured Resource is not converted to a Mineral Reserve because it cannot report as a Mineral Reserve to generate cash flow in the financial model. The Qualified Person's opinion is that it does meet the reasonable prospects for economic extraction criteria as it contributes to the mining process at a variable cost and is not material to the Mineral Resource disclosure.

c) No year-on-year Mineral Resource comparison is presented as South Deep did not disclose a Mineral Resource in 2020.

d) Quoted as diluted in situ metric tonnes and grades. Metallurgical recovery factors have not been applied to the Mineral Resource estimates. The approximate metallurgical recovery factor is 96.5 %. The metallurgical recovery is the ratio, expressed as a percentage, of the mass of the specific mineral product actually recovered from ore treated at the plant to its total specific mineral content before treatment.

e) The underground Mineral Resources are typically confined using Mineable Shape Optimiser (MSO) software to generate realistic stope design geometries encompassing minimum mining width and cut-off grades.

f) The metal prices used for the 2021 Mineral Resources are based on a gold price of $1,500 per ounce or ZAR 750,000 per kilogram (at an exchange rate of ZAR 15.55 per $1.00). The gold price used for Mineral Resource estimates approximates 15 % higher than the selected Mineral Reserve gold price.

g) The cut-off grade may vary per area depending on the respective costs, mining method, depletion schedule, expected mining dilution and expected mining recovery. The following are the average or range of cut-off grade values applied to the Mineral Resources are: South Deep North of Wrench and South of Wrench areas 3.0 g/t to 6.0 g/t gold mill feed from underground.

h) The Mineral Resources are based on initial assessments at the Mineral Resource gold price of $1,500/oz and consider estimates of all South Deep costs, the impact of Modifying Factors such as cut-off grade, mining dilution and mining recovery, processing recovery, royalties and taxes. Mineral Resources are also tested through the application of Environmental, Social and Governance (ESG) criteria to demonstrate reasonable prospects for economic extraction.

i) South Deep is 90.495 % attributable to Gold Fields.

j) The Mineral Resources are estimated at a point in time and can be affected by changes in the gold price, US Dollar currency exchange rates, permitting, legislation, costs and operating parameters.

Source: South Deeps CPR 2021

1.5 Mineral Reserve estimates

The South Deep Mineral Reserves as at 31 December 2021 are summarised in Table 1.2. The Mineral Reserves are 90.495 % attributable to Gold Fields and are net of production depletion up to 31 December 2021. The point of reference for the Mineral Reserves is ore delivered to the processing facility.

Table 1.2: South Deep - summary of attributable gold Mineral Reserves at 31 December 2021 (fiscal year end) based on a gold price of $1,300/oz

	Tonnes/ (kt)	Grades/ (g/t Au)	Gold/ (koz Au)	Cut-off grades (g/t Au)	Metallurgical recovery (%)
Underground (UG) Mineral Reserves					
UG Proven Mineral Reserves	14,057	5.4	2,443	4.0 to 4.4	96.5
UG Probable Mineral Reserves	168,325	4.9	26,686	4.0 to 4.4	96.5
Total South Deep Mineral Reserves 2021	**182,381**	**5.0**	**29,129**	**4.0 to 4.4**	**96.5**
Total South Deep Mineral Reserves 2020	186,221	5.3	31,538		
Year-on-year difference (%)	-2 %	-6 %	-8 %		

Notes:

a) Rounding of figures may result in minor computational discrepancies.

b) Refer to Table 15.8 for year-on-year Mineral Reserve comparison.

c) Quoted as mill delivered metric tonnes and run-of-mine grades, inclusive of all mining dilutions and gold losses except metallurgical recovery. Metallurgical recovery factors have not been applied to the Mineral Reserve figures. The approximate metallurgical recovery factor is 96.5 %. The metallurgical recovery is the ratio, expressed as a percentage, of the mass of the specific mineral product actually recovered from ore treated at the plant to its total specific mineral content before treatment.

d) The gold metal prices used for the 2021 life of mine Mineral Reserves are S$1,300 per ounce or ZAR 650,000 per kilogram (at an exchange rate of ZAR 15.55 per $1.00).

e) Dilution relates to planned and unplanned waste and/or low-grade material being mined and delivered to the mill. The mine dilution factors is 11.5 % over life of mine but ranges from 10.2 % to 24.6 % (underground).

f) The mining recovery factor relates to the proportion or percentage of ore mined from the defined orebody at the gold price used for the declaration of Mineral Reserves. This percentage will vary from mining area to mining area and reflects planned and scheduled reserves against actual tonnes, grade and metal mined, with all Modifying Factors, mining constraints and pillar discounts applied. The mining recovery factors range from 73.8 % to 92.6 % (underground) and is 86.8 % over life of mine.

g) The cut-off grade may vary per area depending on the respective costs, mining method, depletion schedule, expected mining dilution and expected mining recovery. The following are the average or range of cut-off grade values applied to the Mineral Reserves are: South Deep North of Wrench and South of Wrench areas 3.8 g/t to 4.2 g/t gold mill feed from underground.

h) The following are the average or range of cut-off grade values applied in the planning process: South Deep 4.0 g/t to 4.4 g/t mill feed (underground).

i) A gold based mine call factor (gold called for, over gold accounted for) determined primarily on historic performance but also on realistic planned improvements where appropriate, is applied to the Mineral Reserves. A mine call factor of 100 % has been applied at South Deep.

j) South Deep is 90.495 % attributable to Gold Fields and is entitled to mine all declared material located within the property's mining right and all necessary statutory mining authorizations and permits are in place or have reasonable expectation of being granted.

Source: South Deeps CPR 2021

The South Deep Mineral Reserves are the economically mineable part of the Measured and Indicated Mineral Resources based on technical and economic studies completed to a minimum of a pre-feasibility level based on the Mineral Reserve gold price of $1,300/oz to justify their extraction as at 31 December 2021. The South Deep life of mine Mineral Reserve has a pre-feasibility study estimated accuracy of ± 25 % with a contingency not more than 15 %.

1.6 Capital and operating cost estimates

Major budgeted capital cost items for the 31 December 2021 Mineral Reserve life of mine plan include mining development, infrastructure (shafts and plant) upgrades, production fleet together with Environmental, Social and Governance (ESG) expenditure aligned with net zero carbon by 2050. A 5 % capital contingency is carried from 2024 in the life of mine to the end to the value of $213 million.

The forecast capital costs are summarised in Table 1.3. for the first ten years of the life of mine plan.

Table 1.3: Capital costs

Capital cost $ million	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total capital expenditure	114	88	98	86	80	88	67	77	82	79	81

Notes:
a) Ten-year summary
b) Capital cost detail can be found in Item 21
c) This capital summary estimate is for the Mineral reserve life of mine schedule

Source: South Deeps CPR 2021

Budgeted operating costs for the 31 December 2021 Mineral Reserve life of mine plan are summarised in Table 1.4.

Major operating cost drivers for the life of mine include mining costs inclusive of all direct mining, engineering maintenance and backfill placing activities in the mining areas. Processing costs include tailings and waste disposal expenditure. Other operating costs include allocated centralised costs inclusive of health and safety, mine technical services, fix plant engineering, occupational environment and hygiene, environmental management and implementation of ESG initiatives, human resources, finance and other typical centralised costs.

Table 1.4: Operating costs

Operating cost $ million	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total operating costs	347	347	365	368	358	339	339	344	340	319	307

Notes:
a) Ten-year summary
b) Operating cost detail can be found in Item 21 and the economic evaluation in Item 22
c) This operating cost summary estimate is for the Mineral Reserve life of mine schedule

Source: South Deep CPR, 2021

All post closure cost together with rehabilitation costs are legislated to be catered for the in form of a contribution totalling up to the required closure cost estimate. This is performed by an accredited external party and is currently estimated at $42 million and includes post closure figures. This is excluded from the operating costs but included in the other cost for cash flow purposes as displayed in Item 22.

Provision has also been made for concurrent rehabilitation to the value of $4 million in operating cost.

1.7 Permitting

South Deep converted its mining right (old order) to new order mining rights in July 2010, as required by the MPRDA. The new order mining right was granted for the mining area totalling 4,268 ha for a period of 30 years with the option to renew. Key permits that support the mining are in place, these include Water Use Licence (WUL), Environmental Management Plan (EMP), Air Emissions Licence (AEL), Explosives Permit, National Nuclear Regulator Certificate as well as Environmental Authorisation for the Solar Plant.

1.8 Conclusions and recommendations

The South Deep Mineral Reserves currently support an 80-year life of mine plan to 2101 that values the operation at a post-tax net present value of $572 million at a discount rate of 9.4 % and the Mineral Reserve gold price of $1,300/oz.

The exclusive Mineral Resource (Measured and Indicated) amounts to 18.2 Moz with the Inferred at 6.0 Moz and the Mineral Reserve amounts to 29.1 Moz as at 31 December 2021 with a life of mine average All in Cost of $1,016 per ounce and a free cash flow margin of 16 %. The Mineral Resources are 90.495 % attributable to Gold Fields and are net of production depletion up to 31 December 2021.

Importantly, the South Deep Strategic Framework that focusses on the operation's purpose, vision, balanced score card objectives, improvement themes and the aspiration to be a safe, low-grade bulk mechanised and profitable mine, is engrained in the current Mineral Reserve and life of mine disclosure. Sustaining traction on these areas remains integral to facilitating delivery on the production ramp-up and is pivotal to maintaining the mine's trajectory to deliver life of mine steady state volumes and projected financial metrics. The Mineral Reserves are further underpinned by South Deep's aspiration to be the beacon of pride for the Company's people, its communities, stakeholders and shareholders.

South Deep demonstrated tangible progress and a strong financial and operational recovery to the COVID-19-related restrictions experienced in 2020-2021. The mine improved in most key measures during this period, attributed to productivity improvement programs and restructuring introduced towards the end of 2018, and are starting to bear fruit, the increased gold production has been due to improved volume and grade mined.

Significant logistical improvements are anticipated due to independent ventilation districts, new capital infrastructure including crushers and conveyors, in-cut ore flow and improved fleet maintenance facilities being operational in 2022. The mining corridors are scheduled to achieve their planned design geometry in 2023. The life of mine plan will continue to be updated and recalibrated with time as more empirical operational data is gathered.

All five of the key tenets underpinning the mine's operational strategy (Shape the Culture, Build Capacity, Manage the Work, Improve the Work, and Sustain the Improvement) have been rolled out. The Maintenance Improvement Program, aligned and integrated with the Siyaphambili Productivity Intervention, continues to show encouraging results, particularly with the reliability of the drill rigs. Six key strategic improvement themes remain pivotal to South Deep's success:

- Purposeful Visible Felt Leadership (PVFL).
- Reinvigorating our leadership system.
- Improving face time.
- Improving the effectiveness of face time.
- Enabling logistics.
- Modernisation (I&T).

Several projects are in place to support and maintain traction on these six themes which are delivering improved results notably on face time effectiveness and the enabling logistics.

An expansive external and independent review of South Deep's Mineral Resources and Mineral Reserves was conducted in 2019 for the 31 December 2018 disclosure and this was reviewed and updated by the same consultants for this 31 December 2021 life of mine plan. This follow-up review provided SRK Consulting (SRK) the opportunity to follow up the previous 2019 audit recommendations SRK have again found the South Deep Mineral Resource and Mineral Reserve to be in accordance with relevant reporting codes and regulatory guidance and reported to the appropriate technical standard with no stated material issues or non-compliances.

Gold Fields' commitment to materiality, transparency and competency in its Mineral Resources and Mineral Reserves disclosure to regulators and in the public domain is of paramount importance to the Qualified Person and the Issuer's Executive Committee and Board of Directors continue to endorse the Company's internal and external review and audit assurance protocols. This Technical Report should be read in totality to gain a full understanding of South Deep's Mineral Resource and Mineral Reserve estimation and reporting process, including data integrity, estimation methodologies, Modifying Factors, mining and processing capacity and capability, confidence in the estimates, economic analysis, risk and uncertainty and overall projected property value.

However, to ensure consolidated coverage of the Company's primary internal controls in generating Mineral Resource and Mineral Reserve estimates a key point summary is provided in Item 24 for reference.

2 Introduction

2.1 Terms of reference and purpose of this Technical Report

This Technical Report was prepared for Gold Fields Limited (Gold Fields, the Company or the Issuer) in accordance with the requirements of National Instrument 43-101 Standards of Disclosure for Mineral Projects (NI 43-101) of the Canadian Securities Administrators, in relation to the South Deep Gold Mine (South Deep) a production stage property in South Africa.

This Technical Report has been prepared for purposes of applicable Canadian securities laws in connection with the proposed acquisition by Gold Fields of all the issued and outstanding shares of Yamana Gold Inc. (Yamana), a company incorporated under the *Canada Business Corporations Act* (the CBCA) whose shares are listed on the Toronto Stock Exchange, the New York Stock Exchange and the London Stock Exchange, pursuant to a plan of arrangement under the CBCA (the Arrangement). The management information circular of Yamana (the Yamana Circular) for the special meeting of Yamana's shareholders to be held to approve the Arrangement will contain certain information regarding the project, including estimates of Mineral Reserves and Mineral Resources for the project effective as of December 31, 2021. In addition, upon completion of the Arrangement, Gold Fields will become a "reporting issuer" for purposes of applicable securities laws in each of the provinces and territories of Canada. Accordingly, this Technical Report has been prepared (i) to support the scientific and technical information concerning the project which will be contained in the Yamana Circular, and (ii) in connection with Gold Fields becoming a reporting issuer in such jurisdictions of Canada. It is understood that this Technical Report will be filed on the System for Electronic Document Analysis and Retrieval (SEDAR) maintained by the Canadian Securities Administrators.

The effective date of this Technical Report is 31 December 2021. This Technical Report does not purport to reflect new information regarding the project arising after such date.

In addition to this disclosure being in line with NI 43-101, the Mineral Resources and Mineral Reserves stated in this Technical Report have also been reported in accordance with the South African Code for the Reporting of Exploration Results, Mineral Resources and Mineral Reserves (SAMREC Code 2016). SAMREC is aligned to the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) Reporting Template November 2019

Unless otherwise specified, all units of currency are in United States dollars ($). All measurements are metric with the exception of troy ounces (oz).

2.2 Qualified Persons and details of inspection

The Qualified Persons responsible for the preparation of this Technical Report are listed in Table 2.1. All the Qualified Persons are eligible members in good standing of a recognised professional organisation (RPO) within the mining industry and have at least five years of relevant experience in the type of mineralisation and type of deposit under consideration and in the specific type of activity that the Qualified Person is undertaking on behalf of the Company at the time this Technical Report was prepared.

Qualified Person has the same meaning as Qualified Persons and vice versa within this report.

2.2.1 Certificates

Dr Julian Verbeek, FAusIMM

CERTIFICATE OF QUALIFIED PERSON

This Certificate of the Qualified Person has been prepared to meet the requirements of National Instrument 43-101 Standards of Disclosure for Minerals Projects Part 8.

a. Name, Address, Occupation

Dr Julian Verbeek FAusIMM, Geologist

Registered Office, Johannesburg: Gold Fields Limited, 150 Helen Road, Sandown, Sandton 2196.

Postnet Suite 252, Private Bag X30500, Houghton 2041

b. Title and Effective Date of Technical Report

Technical Report – National Instrument 43-101 South Deep Gold Mine - 2021

Effective Date: 31 December 2021

c. Qualifications

PhD Geology, University of Natal 1991.

FAusIMM

I am a geologist with 35 years relevant experience in Mineral Resource estimation in multiple commodities including gold, copper and silver in deposit styles of placer, lode gold, porphyry and epithermal. I am currently in full time employment with Gold Fields, in which I have had overseeing involvement in geology and resource estimation at the operating mines and development projects for the Issuer.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43-101 for the sections of the technical report that I take responsibility for.

d. Site Inspection

Has not attended site but has attended virtual reviews.

e. Responsibilities

I am responsible for Items 1-28 of this Technical Report.

f. Independence

I am a full time employee of Gold Fields Limited and hence not independent in accordance with the application of Section 1.5 of National Instrument 43-101.

g. Prior Involvement

I have been employed by Gold Fields since September 2021. I have not visited the South Deep site but have participated in virtual reviews and have reviewed adjacent Witwatersrand type operations.

h. Compliance with NI 43-101

I have read National Instrument 43-101 and Form 43-101F1 and the Technical Report has been prepared in compliance with the same.

i. Disclosure

As of the effective date of the Technical Report, to the best of my knowledge, information, and belief, the parts of the Technical Report that I am responsible for, contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

"Signed and sealed by Julian Verbeek"

"Julian Verbeek" Date: June 30, 2022

Dr. Julian Verbeek

Richard Butcher, CEng, Msc (Eng), FAusIMM (CP), MIMMM, MSAIMM

CERTIFICATE OF QUALIFIED PERSON

This Certificate of Qualified Person has been prepared to meet the requirements of National Instrument 43-101 Standards of Disclosure for Minerals Projects Part 8.

a. Name, Address, Occupation

Richard Butcher, CEng, FAusIMM (CP), MIMMM, MSAIMM

Registered Office, Johannesburg: Gold Fields Limited, 150 Helen Road, Sandown, Sandton 2196.

Postnet Suite 252, Private Bag X30500, Houghton 2041

b. Title and Effective Date of Technical Report

Technical Report – National Instrument 43-101 South Deep Gold Mine - 2021

Effective Date: 31 December 2021

c. Qualifications

Msc (mining engineering)

CEng, FAusIMM (CP), MIMMM, MSAIMM

I am a mining engineer with 41 years relevant experience in Mineral Reserve estimation, assessment, evaluation and economic extraction in gold, copper and silver. I have worked in Resources and Reserves at Barrick, MMG, **SRK, IGL** and Gold Fields for the last **25** years. I also worked at SRK and other Consultancies in estimating Resources and Reserves. I have held various corporate positions and I am currently the Chief Technical Officer for Gold Fields, in which I have had overseeing involvement in mining engineering and technical services matters at various operating mines and development projects for the Issuer.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43-101 for the sections of the technical report that I take responsibility for.

d. Site Inspection

Has attended site on the 15th April 2021.

e. Responsibilities

I am responsible for Items 1-5, 13 & 15-28 of this Technical Report.

f. Independence

I am not independent of Gold Fields Limited in accordance with the application of Section 1.5 of National Instrument 43-101.

g. Prior Involvement

During my 6-year tenure at Gold Fields I have been responsible for providing leading levels of technical standards, technical assurance, technical excellence, operational leadership, project delivery and asset optimisation, to the Issuer. I have had oversight of planning and execution of technical programs for Gold Fields to ensure that all Group technical disciplines are optimised, standardised and leveraged in a manner that delivered benefit across Gold Fields assets, operations and projects. I have had communications with and attended meetings with discipline heads at site and the corporate level.

h. Compliance with NI 43-101

I have read National Instrument 43-101 and Form 43-101F1 and the Technical Report has been prepared in compliance with the same.

i. Disclosure

As of the effective date of the Technical Report, to the best of my knowledge, information, and belief, the parts of the Technical Report that I am responsible for, contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

"Signed and sealed by Richard Butcher"

"Richard Butcher" Date: June 30, 2022

Richard Butcher

The Qualified Persons were appointed by Gold Fields. The RPO affiliation in good standing was also reviewed by Gold Fields.

Table 2.1: List of Qualified Persons

Incumbent	Employer	Position	Affiliation in good standing	Relevant experience (years)	Details of inspection	Responsibility for which Item
Dr Julian Verbeek	Gold Fields	VP Geology and Mineral Resources	FAusIMM - 207994	35	Has not attended site but has attended virtual reviews	This document has been prepared under the supervision of and reviewed by Julian Verbeek. Items 1-28
Richard Butcher	Gold Fields	Chief Technical Officer GFL Group Technical Services	FAusIMM CP - 211182	41	Has attended site on 15/4/2021	Overview and review of document. Items 1-5, 13 & 15-28

Note: a) The Qualified Persons where not all able to attend site in 2021 for Mineral Reserve and Mineral Resource reviews, however, the Mineral Reserve and Mineral Resource were reviewed according to the Item 24 description. Some Qualified Persons have visited the site previous to 2021.

Not all Qualified Persons were able to undertake site visits in 2021 for Mineral Reserve and Mineral Resource reviews, however, the Mineral Reserve and Mineral Resource were reviewed according to the Item 24 description.

2.3 Report version update

This is the maiden Technical Report filed by Gold Fields on the South Deep property in South Africa.

3 Reliance on other experts

The Qualified Person has not identified any information provided by the Issuer for South Deep that requires noting under the reliance on information provided.

4 Property description and location

4.1 Area

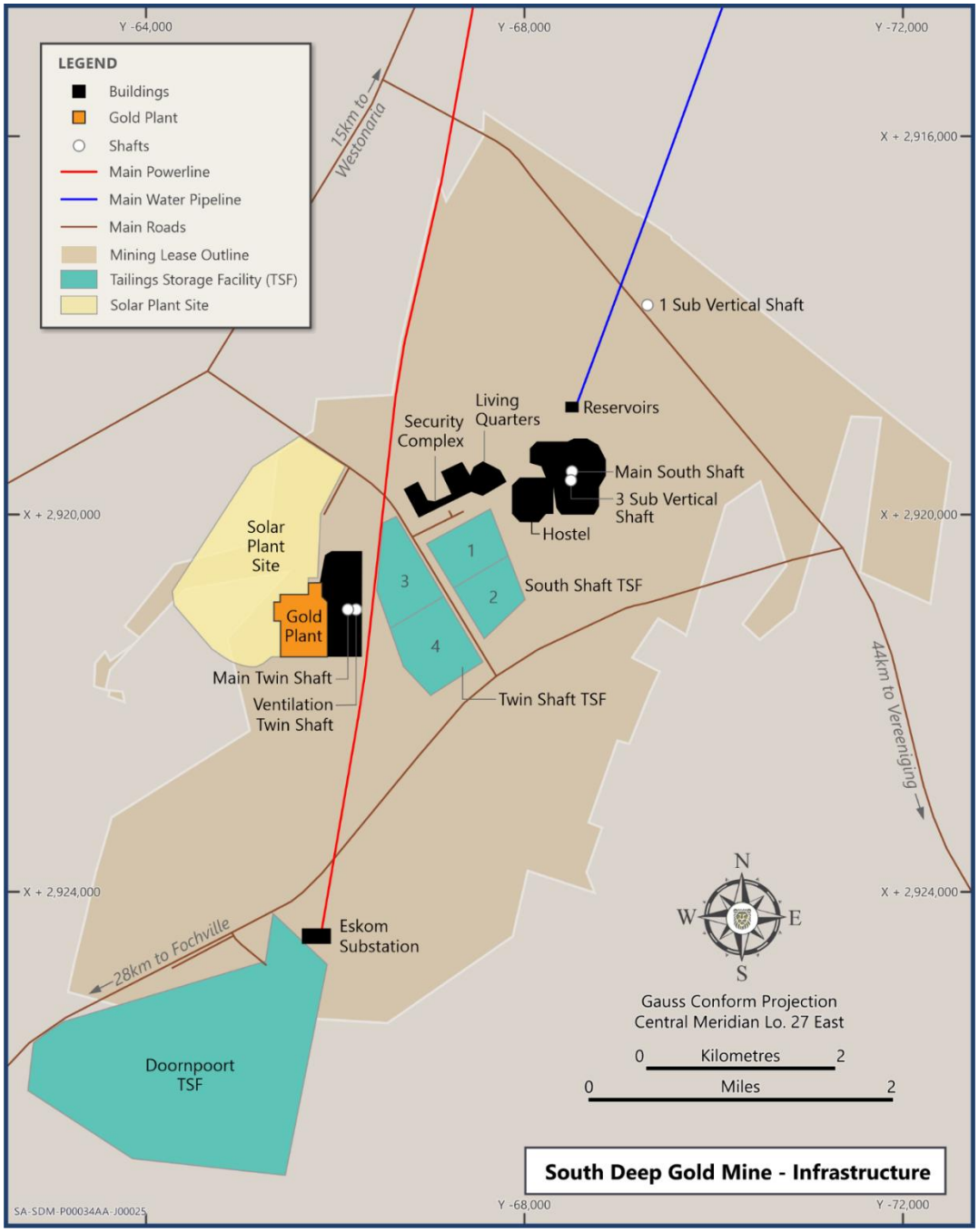
The Company via its partially owned subsidiary Newshelf 899 (Pty) Limited has 90.495 % ownership of a single new order mining right covering 4,268 ha (Figure 4.1 and Figure 4.2).

4.2 Location

South Deep is situated in the magisterial district of Westonaria and Vanderbijlpark (Gauteng Province), some 45 km southwest of Johannesburg at latitude 26.424432˚ S and longitude 27.676855˚E in the Republic of South Africa (Figure 4.1). The property is accessed via the N12 national road between Johannesburg and Potchefstroom.

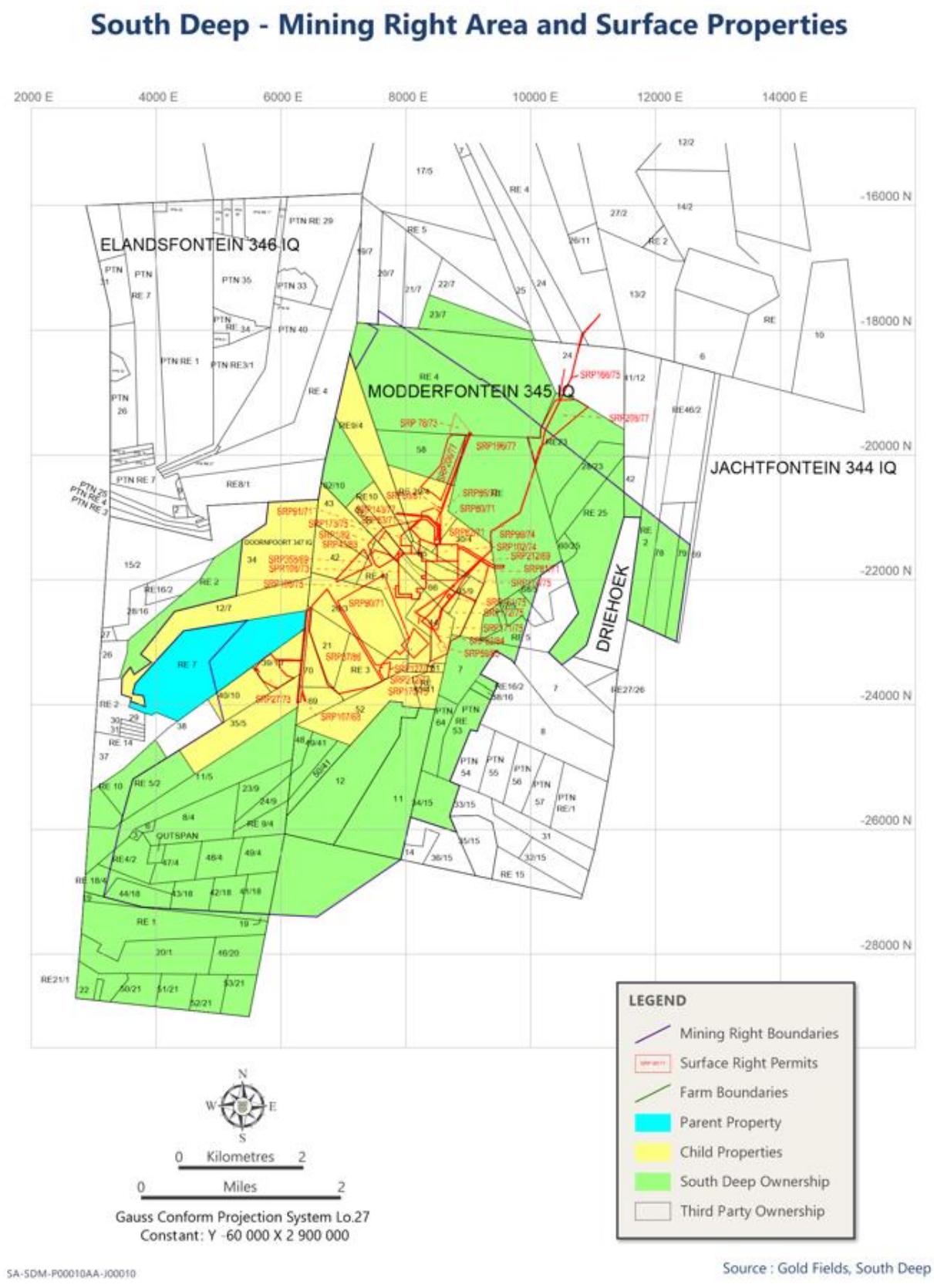
The mine is situated amongst several small towns such as Hillshaven, and Glenharvie which is approximately 7 km from the mine with Westonaria situated approximately 14.5 km by road to South Deep.

Figure 4.1: South Deep surface infrastructure



Source: South Deeps CPR 2021

Figure 4.2 South Deep operating sites, infrastructure and mining right

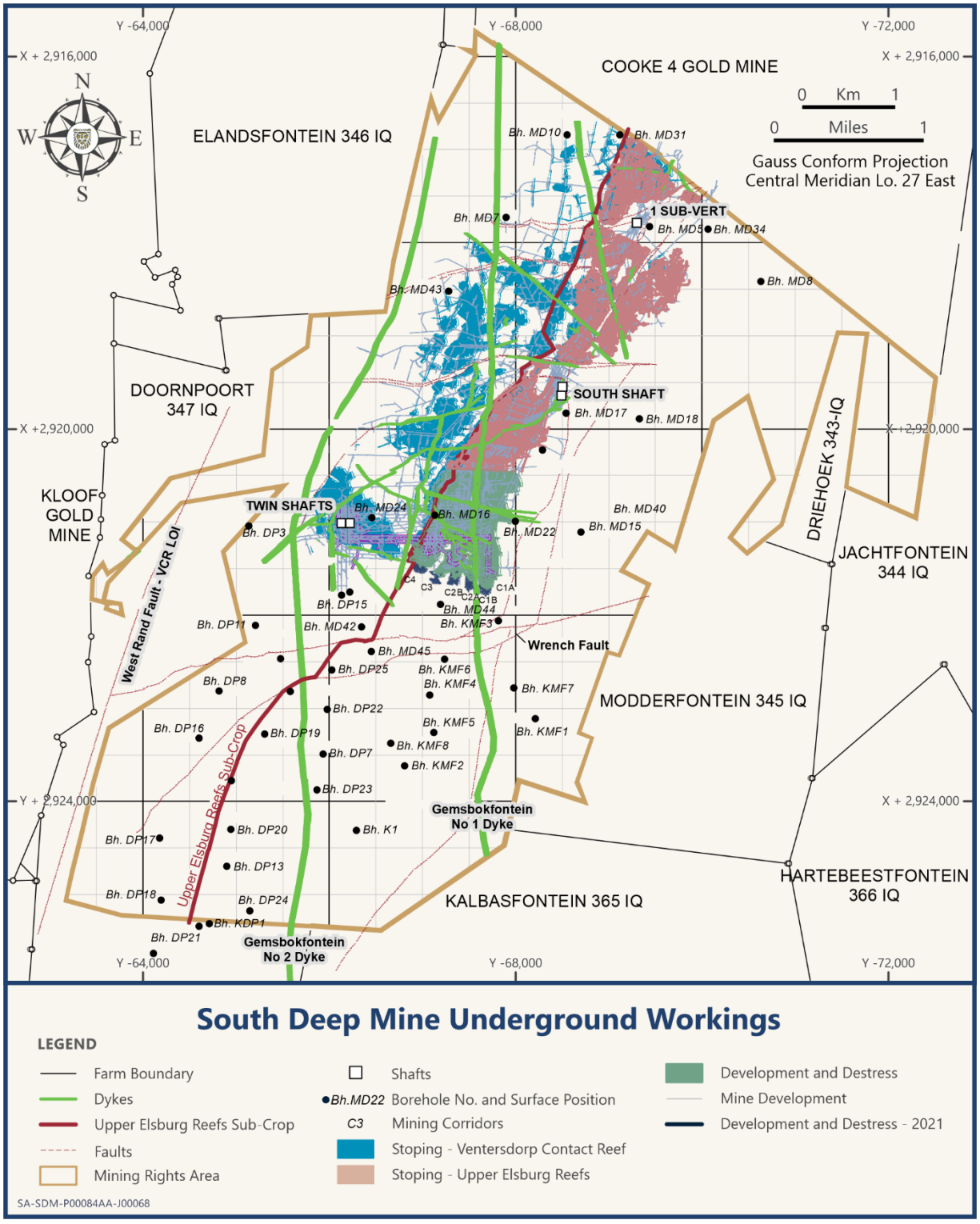


Source: South Deep CPR, 2021

4.3 Type of mineral tenure

The South Deep underground workings and mining right boundaries are shown in Figure 4.3.

Figure 4.3: South Deep underground workings and mining rights boundary



Source: South Deep CPR, 2021

The Mining Charter III was published by the South African Department of Minerals Resources and Energy in 2018The Minerals Council of South Africa elected to challenge the legality of the Mining Charter III. In 2019 an application to review and set aside certain provision of Mining Charter III was issued. On 21 September 2021 the High Court of South Africa handed down a judgment. The judgment confirmed the 'once-empowered, always-empowered' principle. It has the effect that if any mining right holder, at any stage during the existence prior to the publication and commencement of the Mining Charter III, achieved a minimum of 26 % black economic empowerment (BEE) shareholding, will be recognised as compliant with the BEE requirements of the Mining Charter III for the duration of the mining right. Also of importance is that such recognition of the principle does not lapse when the mining right is either to be renewed or to be transferred. It means that existing mining right holders' BEE transactions will be recognised for both the renewal and transfer of an existing mining right and thus the applicant for the renewal of the mining right or the transferee (whichever is applicable), will not be required to comply with the higher BEE ownership requirements as set out in Mining Charter III.

South Deep also holds freehold title to almost all its mining right (Table 4.1); where South Deep conducts surface operations on land it does not own, it does so in accordance with applicable mining and property laws. In addition, South Deep owns prospecting and surface rights contiguous to its operations. As required under the Mineral and Petroleum Resources Development Act 28 of 2002, as amended (MPRDA), South Deep has registered its surface rights utilized for mining purposes.

Additionally, South Deep has received prospecting rights on properties which it has identified as being able to contribute now or in the future to its business and will apply to convert those prospecting rights to mining rights under the MPRDA, when appropriate. These rights include the Fochville East, Kalbasfontein, WA4 and Wildebeestkuil prospecting rights. The Qualified Person is of the opinion that the prospecting rights will not be executed in the foreseeable future. Exploration is expected to be conducted from underground access only.

Table 4.1: List of South Deep mineral rights and freehold titles

South Deep land information	Mining right area
Farm	Portion
DOORNPOORT (347 IQ)	Portion 3 (a portion of Portion 2)
	Remaining Extent of Portion 4 (a portion of Portion 2)
	Remaining Extent of Portion 5 (a portion of Portion 2)
	Portion 6 (a portion of Portion 4)
	Remaining Extent of Portion 7 (a portion of Portion 2)
	Portion 8 (a portion of Portion 4)
	Remaining Extent of Portion 9 (a portion of Portion 4)
	Portion 11 (a portion of Portion 5)
	Portion 12 (a portion of Portion 7)
	Remaining Extent of Portion 18 (a portion of Portion 4)
	Portion 23 (a portion of Portion 9)
	Portion 24 (a portion of Portion 9)
	Portion 34
	Portion 35 (a portion of Portion 5)
	Portion 39 (a portion of Portion 10)
	Portion 40 (a portion of Portion 10)
	Portion 41 (a portion of Portion 18)
	Portion 42 (a portion of Portation 18)
	Portion 43 (a portion of Portion 18)
	Portion 44 (a portion of Portion 18)
	Portion 47 (a portion of Portion 4)
	Portion 48 (a portion of Portion 4)
	Portion 49 (a portion of Portion 4)
JACHTFONTEIN (344 IQ)	Remaining Extent of Portion 2
	Portion 42 (a portion of portion 12)
	Portion 78 (a portion of portion 46)
	Portion 79 (a portion of portion 46)
MODDERFONTEIN (345 IQ)	Remaining Extent
	Remaining Extent of Portion 3
	Remaining Extent of Portion 4
	Remaining Extent of Portion 5
	Portion 7 (a portion of Portion 1)
	Remaining Extent of Portion 9 (a portion of Portion 4)
	Remaining Extent of Portion 10 (a portion of Portion 4)
	Remaining Extent of Portion 16 (a portion of Portion 1)
	Portion 20 (a portion of Portion 3)
	Remaining Extent of Portion 21 (a portion of Portion 3)
	Remaining Extent of Portion 23
	Remaining Extent of Portion 25
	Remaining Extent of Portion 25
	Portion 28 (a portion of Portion 23)
	Remaining Extent of Portion 29 (a portion of Portion 4)
	Portion 30 (a portion of Portion 4)

South Deep land information	Mining right area
	Portion 38 (a portion of Portion 16)
	Remaining Extent of Portion 41
	Portion 42 (a portion of Portion 41)
	Portion 43 (a portion of Portion 41)
	Portion 44 (a portion of Portion 41)
	Remaining Extent of Portion 45 (a portion of Portion 41)
	Portion 47
	Portion 48 (a portion of Portion 41)
	Portion 49 (a portion of Portion 41)
	Portion 50 (a portion of Portion 41)
	Portion of Portion 52
	Portion 58 (a portion of Portion 29)
	Portion 60 (a portion of Portion 25)
	Portion 61
	Portion 62 (a portion of Portion 10)
	Remaining Extent of Portion 63 (a portion of Portion 10)
	Portion 65 (a portion of Portion 9)
	Portion 66 (a portion of Portion 63)
	Portion 67 (a portion of Portion 5)
	Portion 68 (a portion of Portion 5)
	Portion 69 (a portion of Portion 3)
	Portion 70 (a portion of Portion 21)
WATERPAN (292 IQ)	Portion 20 (a portion of Portion 7)

Source: South Deeps CPR 2021

South Deep is entitled to mine all material falling within its mining area and described in its mining right and has all the necessary statutory authorisations in place to conduct the mining operations. In consideration of all legal aspects, the Qualified Person has relied on the regional legal representative of Gold Fields, who verifies that:

a) No significant legal issue exists which would affect the likely viability of the South Deep mine and/or on the Mineral Reserves and execution of the life of mine plan.

b) The necessary licences/titles to all mineral and surface rights have been verified.

4.3.1 Mineral tenure description

South Deep converted its old order mining right to a new order mining right on 13 July 2010 as required by the MPRDA. The new order mining right is valid for a period of 30 years to 13 July 2040. The Qualified Person is of the opinion that the mining rights will be extended to the end of the life of mine Mineral Reserve.

The MRPDA vests the right to prospect and mine in the Republic of South Africa.

All permitting and licensing requirements to start a mining operation, including but not limited to issues of title, heritage, local disturbance, clearing, environmental, power and water extraction/disposal permitting, follow well established legal and effective state/mine authorisation protocols with the relevant state authorities.

4.3.2 Surface rights

South African mining rights do not require the mining rights owner to be the holder of the surface rights.

4.4 Ownership

Barrick Gold Corporation acquired a majority interest in placer Dome Inc. in 2006. Gold Fields acquired Barrick's 50 % joint venture (JV) interest in the Placer Dome-Western Areas JV and in 2007, Gold Fields acquired all remaining Western Areas shares and consequently owned 100 % of South Deep at that time.

In 2010 a new order mining right was granted to Gold Fields with the addition of the contiguous areas known as 'Uncle Harry's'. In 2011 Newshelf 899 (Pty) Ltd (Newshelf), which holds a 100 % interest in South Deep was established which is a 90 % subsidiary of Gold Fields and the remaining 10 % is held by outside shareholders as part of the BEE transaction with 'Invictus'. The 10 % indirect equity interest in South Deep transferred to BEE shareholders is for the full term of the new order mining right granted to South Deep in alignment with the legislated BEE described in the South African Mining Charter and under associated legislation of the MPRDA. This was a requirement for the award of the converted new order mining right.

The BEE shareholders will be entitled to a cumulative preferential dividend which is calculated according to a pre-determined time-based schedule; this schedule is based on an attributable life of mine gold production re-calculated on an annual basis. This arrangement will cease in 20 years' time from inception. The economic ownership of the property therefore changes nominally on an annual basis.

In 2021, Gold Fields holds 90.495 % economic ownership of South Deep.

4.5 Royalties, back-in rights, payments, or other agreements and encumbrances

The following formula is used to calculate the State Royalty on net refinery gold produced at South Deep:

$$\textit{Royalty Rate (\%)} = 0.5 + \frac{EBIT}{\textit{Gross sales (refined)} \times 12.5} \times 100$$

The maximum percentage royalty for refined product is 5 %, whereas the maximum percentage royalty for unrefined product is 7 %. The royalty is determined by multiplying the gross sales value of the operation in respect of that Mineral Resource in a specified year by the percentage determined in accordance with the royalty formula. Both operating and capital expenditure incurred is deductible for the determination of earnings before interest and tax (EBIT).

South Deep received no fines during 2021 and notes no encumbrances for non-compliance or breaches.

4.5.1 Other agreements/interests

There are no royalty or similar interests held by Gold Fields at South Deep.

In 2010, a new order mining right was granted, with the addition of the contiguous area known as Uncle Harry's. Newshelf was established in 2011 holding a 100 % interest in the South Deep Gold Mine. Newshelf is a 90.495 % subsidiary of Gold Fields with the remaining 9.505 % held by outside shareholders as part of the BEE policy. Refer to Item 4.3 for more detail on the empowerment policy arrangements.

4.6 Environmental liabilities

Item 20 discloses the remediation and reclamation guarantees that are pertinent to South Deep.

4.7 Permits

Item 20 discloses all relevant permits required for mining to be undertaken at South Deep.

4.8 Other significant factors and risks

Notwithstanding the Cooke 4 (Ezulwini) mine partial closure and regional dewatering issue outlined below, the Qualified Person is not aware of any other current or pending legal matters that may have an influence on the rights to explore or mine for minerals at South Deep. A review of recent Company public disclosure documents including the annual report (Form 20-F for the 12 months Ended 31 December 2021) do not contain any statements by the directors on any legal proceedings or other material conditions (other than as set out above) that may impact on the Company's ability to continue mining or exploration activities at South Deep.

On 31 August 2016, Sibanye-Stillwater Limited (Sibanye) announced that it would be closing its Ezulwini (Cooke 4) Shaft. Sibanye commenced with an application for an Environmental Authorisation for closure and the cessation of dewatering from the Ezulwini mine. On 30 April 2018, the DMRE refused the Environmental Authorisation for partial closure and cessation of dewatering. Sibanye appealed the finding, and Sibanye made new submissions and submissions were made by Interested and Affected Parties, such as South Deep, by May 2019. Subsequent to the additional submissions, the Basic Assessment Environmental Authorisation was refused on 3 December 2020.

Prior to the final decision from the DMRE, Ezulwini brought an application for a declaratory order in June 2019, against seven respondents, including South Deep, in relation to the cessation of dewatering from Ezulwini (Cooke 4) Shaft. South Deep opposed this application and filed a counter application seeking to ensure Ezulwini remains responsible for the pumping and dewatering of the shaft up and until the DMRE issued a closure certificate. Judgment was received on 15 January 2021 whereby Ezulwini remains responsible for the pumping and treatment of the extraneous water from the underground workings up until the Minister issues a closure certificate in terms of Section 43 of the MPRDA. On 4 February 2021, Ezulwini filed a "Notice of Application for Leave to Appeal".

In summary, the grounds for the Application for Leave to Appeal are that the Judge erred in terms of the obligations of holders of mining and related rights in relation to the pumping and treatment of extraneous water. In the meantime, Rand Uranium, also a subsidiary of Sibanye, started with a Basic Assessment Process for the closure of Cooke 1 to 3 in October 2021. South Deep submitted its objection as part of the public participation process to the Environmental Authorisation on 16 November 2020. An objection to the Water Use Licence (WUL) application submitted by Rand Uranium was submitted on 14 December 2020. The ultimate outcome of these matters, including its impact on South Deep, remains uncertain. However, the cessation of pumping by Sibanye and dewatering of Cooke 4, as well as the regional closure of the bigger area that includes Cooke 3, 2 and 1 could have a material adverse effect on South Deep's business.

The Qualified Person is of the opinion that Item 4.8 is deemed legal matters outside the expertise of the Qualified Person, such as statutory and regulatory interpretations affecting the mine plan and can be relied upon. The Qualified Person is of the opinion that the reserve techno economic model would support any additional costs not included due to the above risk

5 Accessibility, climate, local resources, infrastructure and physiography

5.1 Topography, elevation, and vegetation

The topography of the property is relatively flat with elevations ranging from 1,504 to 1,708 meters above mean sea level. The vegetation of the area is classified as Bankenveld, consisting of various grassland species. Livestock farming is widespread in the surrounding area.

5.2 Access

South Deep is accessed via the N12 provincial road between the city of Johannesburg and the town of Potchefstroom. The nearest railway siding is at Westonaria. International access is via air is through the O.R. Tambo and Lanseria international airports east and north-west of Johannesburg respectively. Access via sea is through Durban harbour.

5.3 Proximity to population centre and transport

South Deep is proximal to the following population centres, by road:

- 6 km southeast of Glenharvie (population of 5,030; 2011 census estimate).
- 8 km south of Hillshaven (population of 2,561; 2011 census estimate).
- 14.5 km south of Westonaria (population of 10,259; 2011 census estimate).
- 57 km southwest of Johannesburg (population of 5.64 million; 2019 census estimate).

5.4 Climate and length of operating season

The regional climate is classified as 'Cwb' (warm temperature, winter dry, warm summer) under the Köppen-Geiger climate classification. The climate of the general area is characterised by mild winters and warm summers. Mean midday temperatures range from 18 °C in June and July to 28°C in December and January. The region is the coldest during July when the mean daily minimum temperature drops to 2 °C on average during the night.

Rainfall averages around 560 mm per annum, with most occurring during the months of December and January (summer rainfall area). The lowest rainfall is usually experienced in June and July during the winter months.

No extreme climactic conditions are experienced that materially affect operations. South Deep does experience short cycled inclement weather and thunderstorms in summer.

5.5 Infrastructure

South Deep is a deep level gold mine employing bulk mechanised mining methods targeting the shallow-dipping, stacked gold bearing reefs. The mine has a long history of production with current operations focused on mining the Upper Elsburg formation reefs. Key required infrastructure is installed and operational to support the production build-up to steady state production levels. Additional in-cut infrastructure is scheduled for completion in 2022-2023, which in turn will lead to production efficiencies.

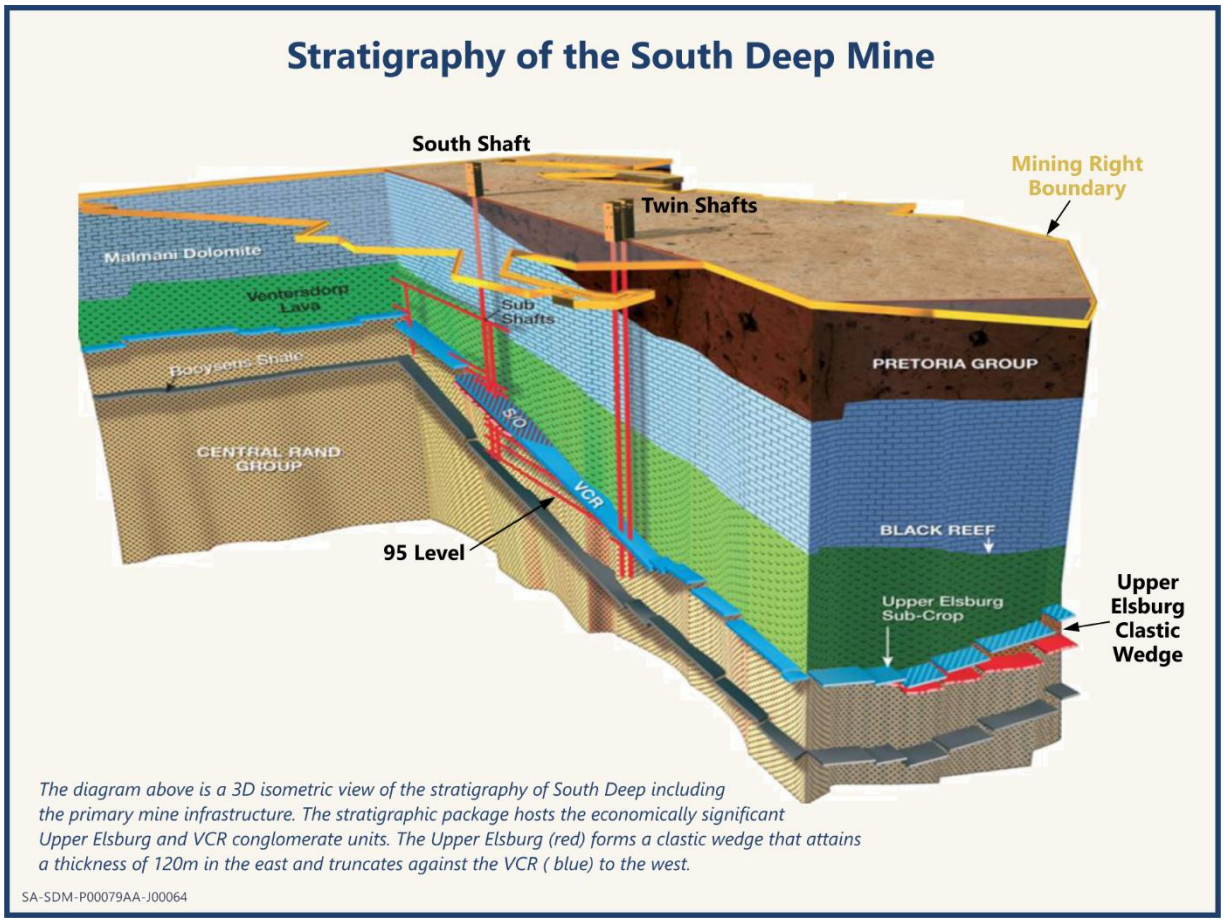
South Deep's significant infrastructure comprises:

- Two shaft complexes (Twin Shaft Complex and South Shaft Complex) utilising three surface shafts and three sub-vertical shafts:
    - Twin Shaft Complex - Main Shaft (for personnel, material, services and rock hoisting) and Ventilation Shaft (for rock hoisting, services and return ventilation).
    - South Shaft Complex - South Shaft Main (for personnel, material, services and return ventilation), South SV1 Shaft (not active), South SV2 Shaft (for services), South SV3 Shaft (for personnel, material and services) and access development on five active levels.

- Ore handling facilities and crushers (track-bound transport with ore pass systems and loading systems converting to trucking, crushing and conveyor systems).
- A carbon-in-pulp (CIP) for run-of-mine and carbon-in-leach (CIL) for the tailings retreat process plants.
- Tailings storage facilities (TSF).
- Refrigeration and ventilation facilities.
- Equipment maintenance workshop facilities.
- Backfill facilities.
- 50 megawatt (MW) solar plant (under construction)
- General infrastructure for organisational requirements.

The South Deep underground mine is currently accessed from the surface through the Twin and South Shaft Complexes. Twin Shaft Complex comprises a Main Shaft with a single drop to 110A Level (a depth of 2,998 meters below surface) and the Ventilation Shaft to 110 Level (a depth of 2,947 meters below surface). The South Shaft Complex is a subvertical shaft system to 95 Level (a depth of 2,786 m below surface, Figure 5.1).

Figure 5.1: 3D cut-away schematic of South Deep mine – view north-west



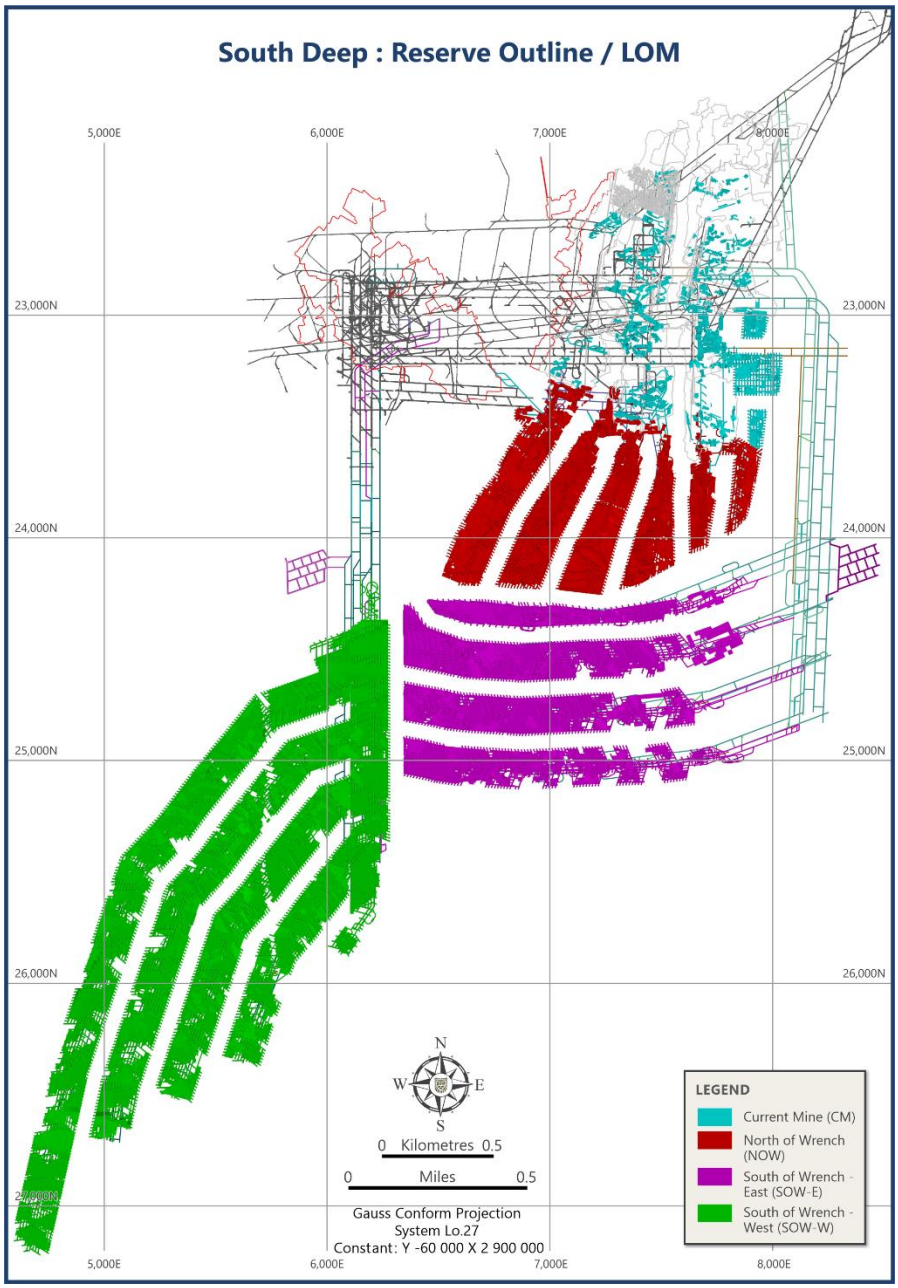
Source: South Deep CPR, 2021

The lowest planned working level is at approximately 2,900 m below surface. The 110 Level decline infrastructure will access additional Mineral Reserves down to approximately 3,300 m below surface. The shaft systems are expected to be adequate for the life of mine Mineral Reserve extraction.

The mine is divided into three main areas:

- Current Mine (CM) characterised by selective mining methods scattered over a large area and originally exploited by means of conventional tabular mining. The CM is accessed from three active levels (90, 93, 95) from both the Twin Shaft and South Shaft complexes.
- North of Wrench (NoW) directly south and down dip of CM comprising six mining corridors separated by regional pillars that extend southwards to the Wrench Fault. This area is largely unmined with a bulk non-selective mining method to be applied.
- South of Wrench (SoW) east and west areas situated south and down dip of NoW to be mined in a similar manner as NoW. Access to the SoW areas require capital infrastructure development (Figure 5.2).

Figure 5.2: South Deep life of mine footprint



Source: South Deep CPR, 2021

Mining, in the medium term, is focussed on CM and NoW with the objective of confirming business fundamentals through completion of an investment study focussed on the SoW area which will confirm and/or assess alternative access, mine design and sequencing options to optimise capital investment regarding the establishment of the SoW area as the takeover mining front for NoW in approximately 15 years' time, with first extraction scheduled from SoW west in circa 2035. The SoW area becomes the main contributor of underground ore from circa 2055 when the NoW Mineral Reserves are depleted.

The process plant is located approximately 1 km west of Twin Shaft and consists of a conventional semi-autogenous grinding mill (SAG)/ball milling circuit, a gravity gold recovery circuit and a Gekko® InLine Leach Reactor in conjunction with a Gemini Table. The plant also includes a tailings retreatment gold recovery section for the tailings material being prepared for hydraulic backfill support in the stope voids and it consists of a thickener followed by a dedicated CIL circuit.

South Deep operates one active TSF (Doornpoort TSF) and has four dormant facilities (TSF 1, TSF 2, TSF 3 and TSF 4). TSF 2 is undergoing re-mining using hydraulic re-mining (water cannon). The top portion of TSF 1 was also re-mined.

TSFs 1 and 2 were commissioned in 1968 and are upstream raised paddock dams covering a combined area of 69 ha with a maximum height of 47 m. TSFs 3 and 4 are also upstream raised paddock dams commissioned in 1982, covering a combined area of 100 ha with a maximum height of 41 m. Deposition into these TSFs ceased in 2011. The Doornpoort TSF was commissioned in April 2011, and three upstream wall raises have been constructed. The Doornpoort TSF incorporates a gravity decant system with under drainage structures installed beneath the tailings. Phase 2 of this facility has a remaining life of mine storage capacity of circa 149 Mt, resulting in a total capacity of circa 205 Mt.

Reliable and cost-effective electrical power supply in South Africa remains a significant risk. The national power supply grid remains relatively constrained, which often leads to load curtailment. Since the mine is not shaft or mill constrained, spare capacity exists in these large power consuming activities, offering the mine flexibility during load curtailment. However, this does not fully mitigate the risk and could hamper productive output. The mine was granted a generation licence for a 40 MW photo voltaic solar plant from the National Energy Regulator of South Africa in February 2021. Although originally specified and approved at 40 MW, it was later decided to expand it to 50 MW using more efficient (though still more) panels. Applications for the additional 10 MW have been submitted to NERSA and Eskom. Commissioning is planned for Q3 2022.

With the solar plant in place, the risk exposure will reduce and will lower the mine's consumption and environmental impact. The solar plant will cover up to 20 % of energy consumption for South Deep, thus reducing carbon footprint and reliance on Eskom.

There are several small towns located around South Deep, including Glenharvie, Hillshaven and Westonaria, all located within 15 km from the mine. Facilities include general shopping, medical centre and some industrial businesses. The extent of the underground workings on the VCR and Upper Elsburg reef as of December 2021 is shown in Figure 4.3.

6 History

The discovery and development of the West Rand Goldfield can be traced back to 1889. The payable VCR and Upper Elsburg reefs were first intersected in the early 1950s in the southern part of the area. By 1959, after an intensive drilling program with encouraging results, the Western Areas Gold Mine was established. Western Areas Gold Mining Company Limited and a syndicate headed by Johannesburg Consolidated Investment Company Limited continued prospecting further south and by 1965 it was established that the VCR and Upper Elsburg orebodies being mined at the Western Areas Gold Mine extended further southwards.

This exploration led to the establishment of the Elsburg Gold Mining Company Limited, which was later consolidated with Western Areas Gold Mining Company Limited to become known as the Western Areas Gold Mining Company Limited South Division. Further exploration in the late 1970s confirmed earlier indications that the Upper Elsburg reef horizons extend well to the south in the area, which become known as the South Deep Project Area.

By 1980 it was recognized that the South Deep orebody had potential for wide orebody mechanized mining. In the following years, surface and underground drilling together with detailed seismic surveys further enhanced the grade distribution and geological models.

In 1990, Western Areas Gold Mining Company Limited transferred the land and mineral rights to South Deep Exploration Company Limited and subsequently merged in 1995 to become Western Areas Limited (WA). This period also saw the sinking of Twin Shaft and access development from South Shaft commenced.

In 1999, the Placer Dome/Westonaria joint venture was formed and in 2000 the mine was renamed South Deep Gold Mine. The new South Deep gold plant was commissioned in 2002 and the South Shaft plant decommissioned. The sinking of the main shaft was completed and in 2004 the Twin Shaft system was commissioned.

During late 2006 and early 2007 Barrick Gold Corporation (Barrick) acquired a majority interest in Placer Dome. Gold Fields subsequently acquired Barrick's 50 % interest in the Placer Dome/ Westonaria joint venture and in 2007 Gold Fields acquired all remaining WA shares and attained full ownership of the South Deep Gold Mine. Between 2008 and 2009 all conventional mining was stopped and low-profile mechanised de-stress mining was initiated.

A 3D seismic survey conducted in 2004 provided resolution into the major structures present at South Deep, which was incorporated into the geological model. Following Gold Fields acquisition of South Deep in 2008, a total of 49.5 km of surface drilling was completed to November 2013. All subsequent drilling was completed from underground.

In 2010, a new-order mining right was granted, with the addition of the contiguous area known as Uncle Harry's. Newshelf was established in 2011 holding a 100 % interest in the South Deep Gold Mine. Newshelf is a 90.495 % subsidiary of Gold Fields with the remaining 9.505 % is held by outside shareholders as part of the BEE policy.

In 2017, the high-profile de-stress mining method was successfully implemented, and the "Rebase Plan" designed to enable a strategic re-positioning of the mine, was initiated. The Rebase Plan incorporated improvements in mine design, production sequencing, geotechnical parameters, equipment productivities and necessary infrastructure required to support the production plan and productivity programs.

In 2018, a major restructuring was initiated in support of a new operating model designed to improve operational efficiency, reduce operating costs and leverage cash flow. The restructuring plan was embedded in 2019, which incorporated a reduced workforce and mobile equipment levels aligned to overall mining activity that increased focus on the core productivity process and supported a recalibration of the cost base. In 2020, the mine continued to progress on most of the performance metrics relative to 2019, including production quality and efficiency measures, with a notable improvement in stope extraction compliance with design improving year-on-year.

The 2021 operational delivery continued to demonstrate sustained improvements in most performance metrics with new de-stress and pillar design modifications, improved back filling capability, enhanced stope sequencing and the

mine’s modernisation program leveraging the implementation of innovation and technology initiatives, all underpinning solid progress with the production ramp-up plan to the steady state 12 tonnes of gold per annum.

The recent production performance of South Deep is summarised in Table 15.1.

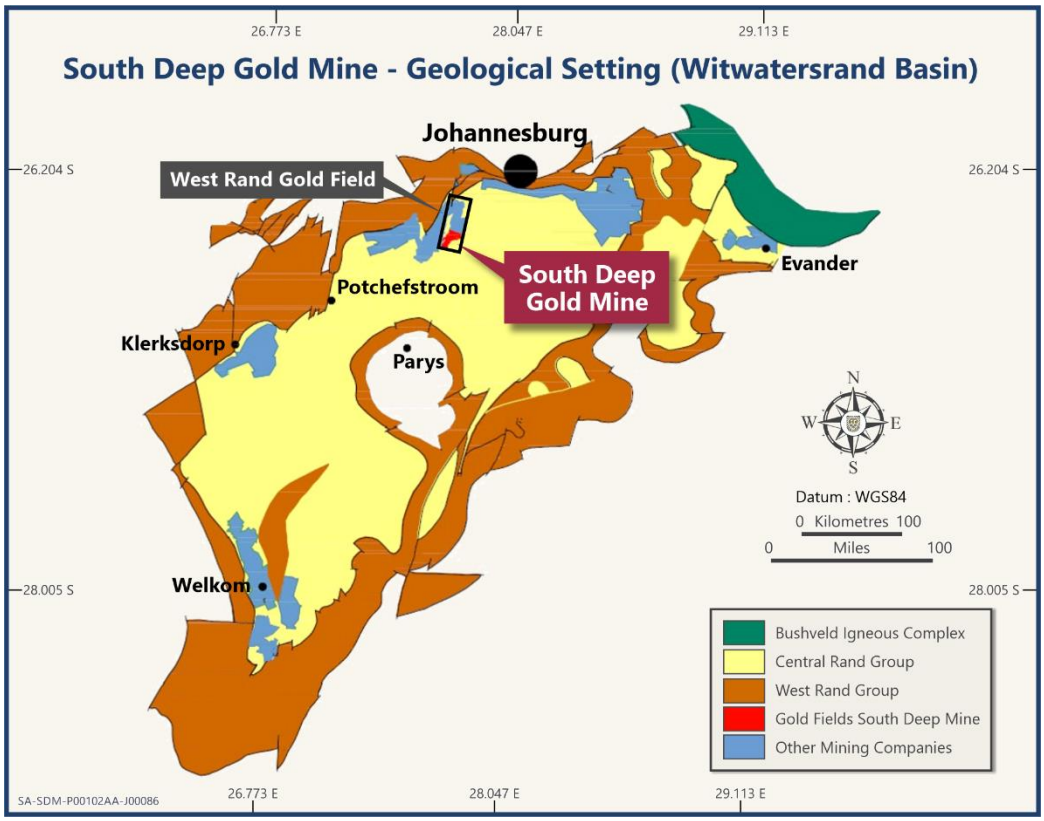
The Qualified Person is of the opinion that the historic exploration results have been incorporated into the South Deep database with the necessary due diligence and technical quality assurance and quality control (QAQC) required to validate the information. Currently mined areas have been superseded and supplemented by more recent resource and mine definition drilling undertaken by Gold Fields and any historic errors or deficiencies will have little influence on the current Mineral Resource models or the life of mine Mineral Reserves going forward.

7 Geological setting and mineralisation

7.1 Regional geology setting

South Deep exploits a unique orebody that lies at the north-western edge of the geologically world-renowned Archean Witwatersrand Basin, in a well-established mining area with a circa 140-year history of gold mining known as the West Rand Goldfield. The Witwatersrand Basin comprises argillaceous and arenaceous sedimentary rocks of up to 6 km in vertical thickness and extending laterally for some 300 km east-northeast and 150 km south-southeast within the Kaapvaal Craton (Figure 7.1). The sedimentary rocks generally dip at shallow angles towards the centre of the basin, though locally this may vary. The basin sediments outcrop to the south of Johannesburg, but further to the west, south and east the sediments are overlain by up to 4 km of Archaean, Proterozoic and Mesozoic volcanic and sedimentary rocks. The Witwatersrand Basin sediments are between 2,700 Ma and 3,100 Ma in age.

Figure 7.1: Geology of the Witwatersrand Basin



Source: South Deep CPR, 2021

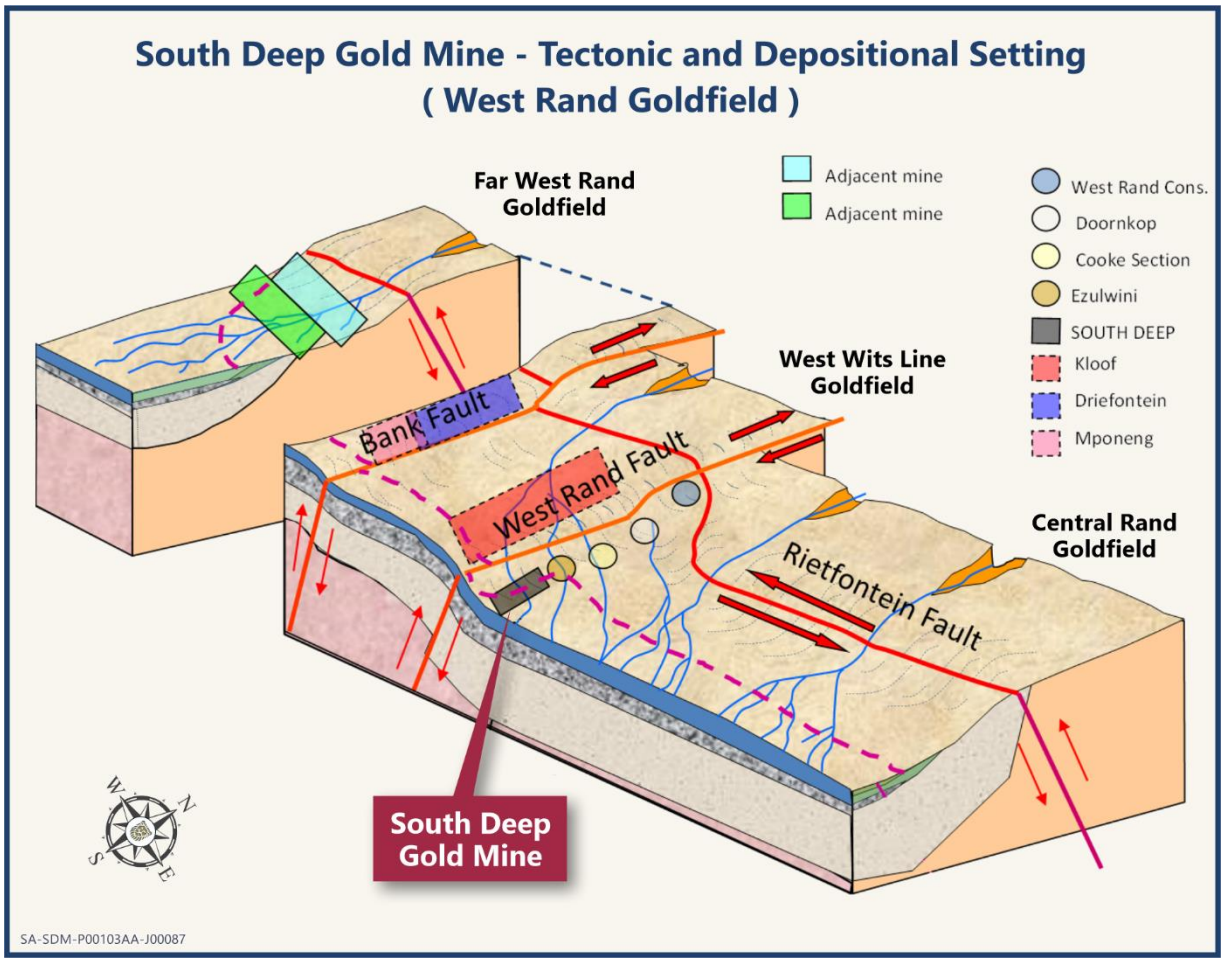
7.2 Local geology setting

The South Deep mining right area or property is underlain by outliers of Karoo Supergroup shales and sandstones, followed by the Pretoria Group sediments and the Malmani Dolomites of the Chuniespoort Group. The Chuniespoort Group overlies the Ventersdorp lavas of Klipriviersberg Group, which in turn are underlain by the Central Rand Group that hosts the gold-bearing conglomerates or reefs exploited by South Deep, specifically the Ventersdorp Contact Reef (VCR) and the Upper Elsburg formation conglomerates. Figure 5.1 shows the stratigraphy, targeted economic horizons and main access infrastructure at South Deep.

Figure 7.2 is a schematic isometric view illustrating the geological depositional setting of various West Rand and Far West Rand mines, including South Deep, relative to major regional geological faults. Fault movement resulting in topographic uplift would have impacted surface drainage patterns and repeatedly re-energised related sedimentological

deposition systems, to ultimately generate the stacked conglomerate units with varying amounts of interstitial and inter-bedded quartzites, that now comprise the Upper Elsburg orebody package. South Deep is mining the youngest reefs within its geological sub basin, with the oldest reef being mined at Doornkop to the north, with the reefs becoming progressively younger to the south, toward South Deep.

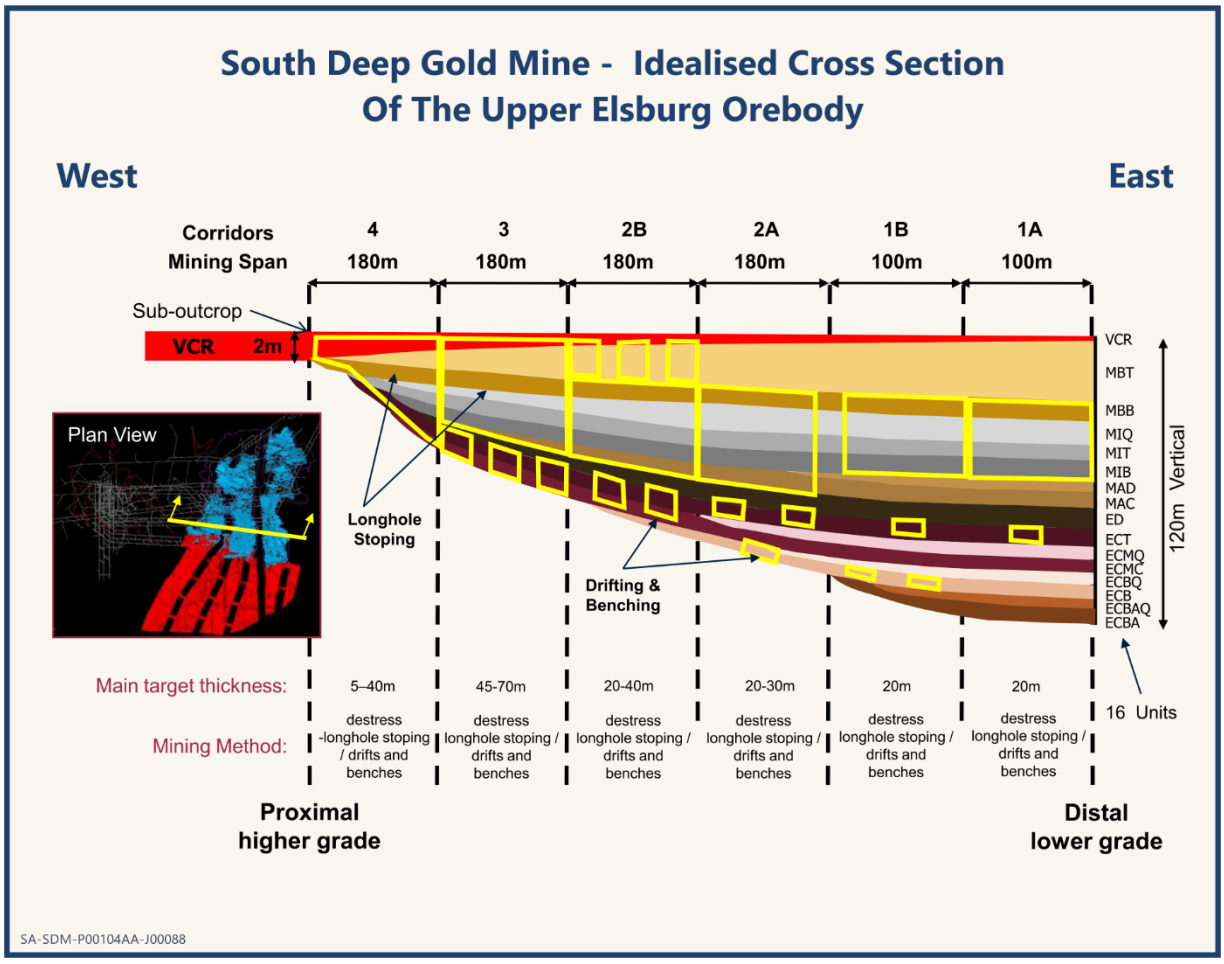
Figure 7.2: Tectonic and depositional setting - West Rand Goldfield



Source: South Deep CPR 2021

Figure 7.3 depicts an idealized west-east cross section across the orebody, looking approximately north, illustrates the wedge-shaped nature of the reef package at South Deep and importantly the subcropping relationships of the reefs as they on-lap each other toward the west where they eventually sub-crop. Repeated transgressions and regressions of the sedimentological depositional system, as a result of ongoing movement focused on the West Rand fault, would have generated the repetitive conglomerate units to eventually build the final Upper Elsburg package.

Figure 7.3: Idealised cross section of Upper Elsburg Orebody at South Deep



Source: South Deep CPR 2021

This cross section also gives an indication of the reef package targeted within each mine corridor. Corridor's 3 and 4 are typically targeted for total orebody extraction while Corridor's 1 & 2, where the package has thickened considerably with increased inter-bedded quartzite units, is targeted for more selective mining which is focused on those units that at practical mining widths exceed the stope selection cut-off grade requirements.

7.3 Mineralisation

Gold mineralisation in the Witwatersrand Basin occurs within uraniferous quartz pebble conglomerate horizons, termed reefs. These reefs occur within seven separate goldfields located along the eastern, northern, and western margins of the basin known as the Evander, East Rand, Central Rand, West Rand, Far West Rand, Klerksdorp and Free State Goldfields respectively. Typically, within each goldfield there are one or two major reef units present, which may be overlain by one or more secondary reef units. As a result of geological faulting and other primary controls on mineralisation, the goldfields are not continuous and are characterized by the presence or dominance of different reef units. The reefs are generally less than 2 m in thickness and are widely considered to represent laterally extensive braided fluvial deposits or unconfined flow deposits which formed along the flanks of alluvial fan systems around the edge of what was effectively an ancient inland sea.

All major reef units are developed above geological unconformity surfaces. The angle of unconformity is typically greatest near the basin margin and decreases toward more distal areas. Complex patterns of syn-depositional faulting

have caused variations in sediment thickness within the basin. Sub-vertical to over-folded reef structures are a characteristic of basin margin features within certain areas.

The gold is deemed primarily of detrital origin, deposited syngenetically with the conglomerates. Although the gold generally occurs in native form and is usually associated with pyrite and carbon, most of it has been subsequently modified and remobilized on a very local scale, typically less than a metre, by secondary hydrothermal processes.

Most early theories considered that the gold was deposited syngenetically with the conglomerates, but subsequent research has confirmed that metamorphism within the Witwatersrand Basin caused some limited post depositional redistribution of gold. Other experts regard the gold to be totally epigenetic and deposited solely by hydrothermal fluids, sometime after deposition of the reef sediments.

Despite these varied viewpoints, the most fundamental control to the gold distribution remains the association with quartz pebble conglomerates on intra-basinal unconformities. The reefs are extremely continuous due to the regional nature of the erosional surfaces. Bedrock (footwall) controls govern the distribution of many of the reefs. Preferential reef development within channel systems and sedimentary features such as facies variations and channel frequency assist in mapping out local gold distributions. The drilling, mapping, identification and modelling of erosional and sedimentary features is the key to developing meaningful geological and geozone models required to underpin robust Mineral resource estimation.

There are five primary reefs developed within the Central Rand Group. In chronological order, from older to younger, they are: South Reef, Kimberly's, Lower Elsburg, Middle Elsburg and Upper Elsburg. Deposition of these reefs commenced at the north with the alluvial fans of the various reefs progressing southwards with time.

The Upper Elsburg reef at South Deep is anomalous with respect to the other Witwatersrand reefs developed within the basin due to its massive, divergent nature at depth below the VCR. The other reefs are typical Witwatersrand deposits representing narrow, tabular orebodies with distinct channelisation consistent with fluvial dynamics of the Witwatersrand.

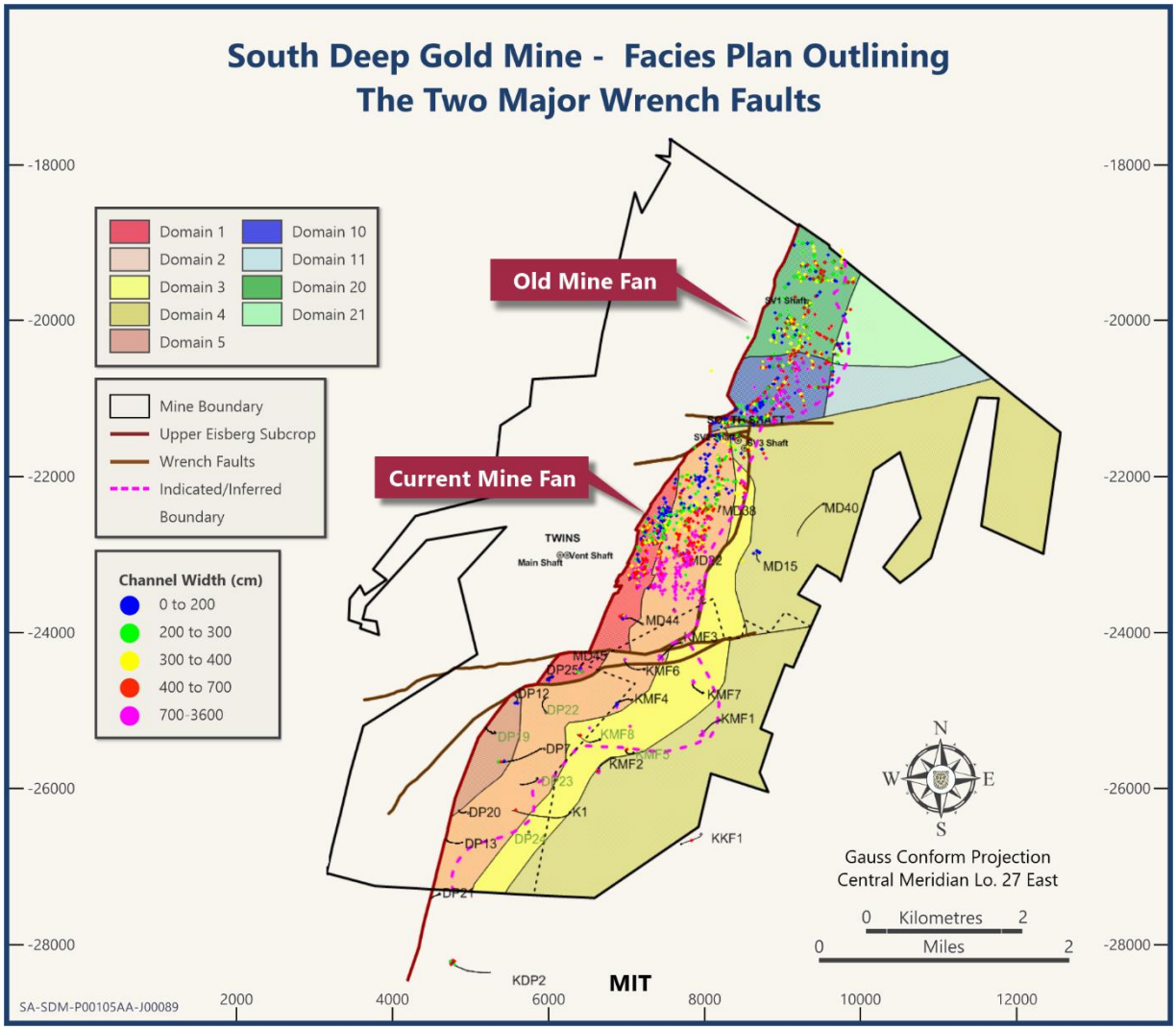
The reefs at South Deep are typically massive in nature with little or no evidence of channelisation and are attributed to a sheet flood type deposit in a very high energy environment. This is believed to be a result of rapid and frequent movement of the syn-sedimentary, east-west trending faults in the vicinity giving rise to a high energy fluvial environment.

In the western half of the South Deep mining right, the VCR reef occurs as a single reef horizon at the base of Ventersdorp lava that overlies footwall lithologies of the Central Rand Group. The Upper Elsburg reef, which sub-crops with the VCR in a north-northeast trend (Figure 4.3), comprises multiple stacked reef horizons that form part of an easterly divergent clastic wedge. This wedge attains a maximum thickness of approximately 120 m to the east and truncates against the VCR to the west (Figure 5.1).

The Upper Elsburg reef comprises up to 16 stratigraphic horizons with alternating quartzite and conglomeratic units. This divergent wedge is believed to be the resultant of rapid movement on syn-sedimentary, east-west trending faults resulting in a series of uplifts with associated transgressions and regressions giving rise to the alternating conglomerate and quartzite units and the staggered nature of the sub-cropping of the various units against overlying units. Due to the high energy environment, a sheet flood type deposit has developed resulting in areas of elevated grades, termed pay trends, being orientated in a north-south direction which is in contrast with a typical Witwatersrand deposit with pay trends aligned to the palaeocurrent direction where distinct channels are present.

Figure 7.4 shows a facies plan reflecting various areas with similar specific reef characteristics which are profiled as distinct geological domains for the Upper Elsburg reef package. The facies plan confirms the syn-sedimentary movement of the east-west trending Wrench Fault by the distinct change in facies north and south of the Wrench Fault. It is believed that these two facies trends represent two individual alluvial fans whose genesis was a consequence of syn-sedimentary movement on the Wrench Fault. The facies data, however, indicates negligible changes in facies across the southern most Wrench Fault which separates the NoW and SoW mining areas indicating minimal syn-sedimentary movement.

Figure 7.4: Facies plan outlining the two major wrench faults

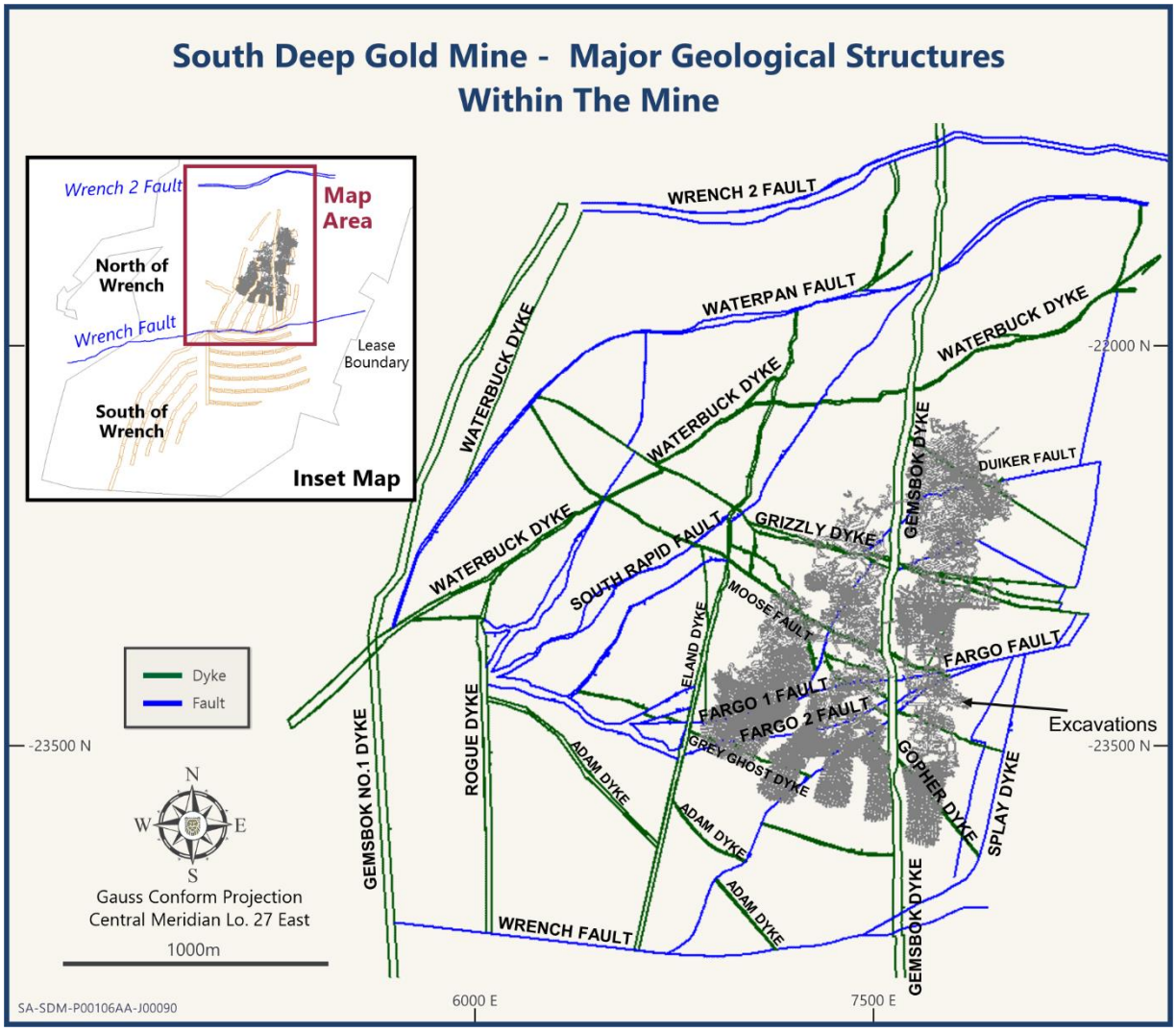


Source: South Deep CPR, 2021

The mine is also traversed by a series of intrusive dykes and geological faults which are of differing ages (Figure 7.5). The dykes are generally north-south and east-west trending. The younger north-south dykes are approximately 30 m thick and are not associated with any notable displacement. The east-west dykes are commonly associated with displacement in the magnitude of a few metres and range in thickness from 0.5 m to 3.0 m.

Faulting also has two prominent trends, namely east-west and north-south, with the latter being older and displaced by the east-west faults. The faults are steeply dipping with a normal throw and an average magnitude of vertical displacement that rarely exceeds 5 m. However, the most significant displacement is in the lateral sense which is clearly evidenced by displacement of the various dykes and to a lesser extent variance in channel width across faults. The minor faults are generally confined to the reef horizon and do not penetrate significantly into the footwall. The Wrench Fault has an approximate 180 m right lateral movement and between 110 m and 160 m upthrow to the south. The upthrow to the south benefits the mine by enabling a significant portion of the orebody to be accessed by current infrastructure. To date the exploration of the SoW area was primary focussed on improved understanding around the geology, grade and Mineral Resources. The secondary objective and more recent work have placed more emphasis on understanding the Wrench Fault and associated deformation, confirming the sense of displacement of the Wrench Fault, the nature of the Wrench Fault and improving granularity of the orebody in terms of sedimentology and stratigraphy that will lead to improved resource estimation.

Figure 7.5: Major geological structures within the mine and North of Wrench areas



Source: South Deep CPR, 2021

8 Deposit types

South Deep lies at the north-western edge of the Archean Witwatersrand Basin of South Africa within the West Rand Goldfield. Gold mineralisation occurs within uraniferous quartz pebble conglomerate horizons, termed reefs. The reefs are generally less than 2 m in thickness and are widely considered to represent laterally extensive braided fluvial deposits or unconfined flow deposits which formed along the flanks of alluvial fan systems or deltas. All major reef units are developed above stratigraphic unconformity surfaces.

The Upper Elsburg formation conglomerates constitute the target economic horizon at South Deep and constitute 100 per cent of the South Deep Mineral reserve ounces. The Upper Elsburg conglomerates sub crop or truncate below the Ventersdorp Contact Reef (VCR) in a north-north-west trend and are anomalous with respect to the other Witwatersrand reefs as they comprise multiple stacked reef horizons forming an easterly-divergent massive clastic wedge which attains a maximum thickness of approximately 120 m to 130 m in the vicinity of the eastern boundary of the mining right area. In the western half of the South Deep mining right, the Ventersdorp Contact Reef occurs as a single reef horizon that overlies the Turffontein Subgroup and is covered by the Ventersdorp lavas and the VCR contributes to the Mineral resource only at this juncture.

The gold is deemed primarily of detrital origin, deposited syngenetically with the conglomerates. Although the gold generally occurs in native form and is usually associated with pyrite and carbon, most of it is interpreted to have been subsequently modified and remobilized on a very localized scale by secondary hydrothermal processes.

Item 9 provides details on exploration and resource development.

9 Exploration

9.1 Exploration and resource development

The property's Mineral Resource base comprises less than 10 per cent Inferred Mineral Resource material and is predominantly classified as Indicated Mineral Resource with Measured Mineral Resource material constrained to areas covered by close spaced mine definition drilling. Given South Deep is a well-established production stage property, albeit still in the production ramp-up phase to full steady state production, with a significant Mineral Resource and Mineral Reserve base, it does not have exploration targets to disclose. South Deep's focus going forward is on resource development pivotal on phased underground drilling programs integrated with 3D seismic and geological modelling to drive continuous improvement in the resource estimation that is the foundation for the life of mine design and scheduling.

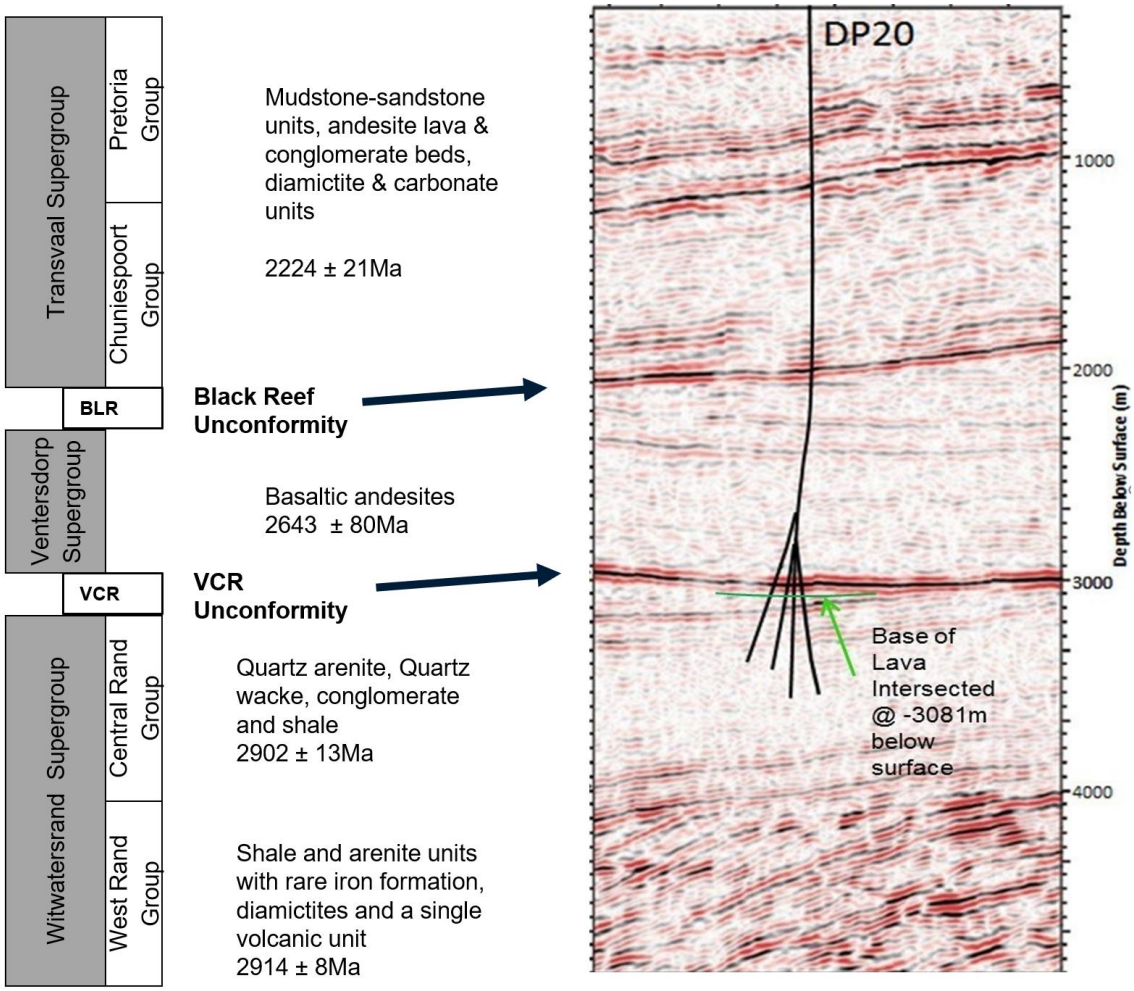
Given this context and under Gold Fields' ownership and operation South Deep has a track record of consistent resource development to ensure Measured Mineral Resources are available to modify to Proven Mineral Reserves on an annual basis to replace production depletion. South Deep's strategy of consistent annual investment in resource definition drilling and mine definition drilling has proved successful and continues to deliver operational flexibility and sustain production at planned levels.

The following geoscience projects were progressed in 2020-2021 with a focus on Mineral Resource development and supporting future mining optimisation studies for both the NoW and SoW areas:

- Re-processing the 2004 3D seismic data volume through application of the latest re-processing and modelling techniques.
- Structural model enhancements based on the seismic re-processing coupled to updated structural modelling and an assessment of the regional tectonic history.
- Palaeoenvironmental reconstruction to improve understanding of the Upper Elsburg and VCR fluvial environment and interpretation on a regional and mine scale to support facies and geo-domaining in the deeper parts of the property.
- Updated sedimentological modelling of the Upper Elsburg based on the palaeoenvironmental study work and empirical data and learnings from NoW and CM.
- Revised Geozones to constrain an updated geostatistical evaluation of the NoW and SoW Upper Elsburg to support future mining optimisation studies.
- Optimised LIB drilling program based on the enhanced geological modelling and resource estimation studies listed above to enhance the long-inclined borehole drilling program targeting the SoW area to the south of the Wrench Fault to maximise geological return on investment.

The 2004 3D surface vibroseis seismic survey facilitated improved structural modelling across the South Deep mining right area. The survey provided high quality data of the VCR acoustic reflector and the structures responsible for its relative displacements. Seismic resolution achieved was based on the seismic survey bin size deployed and equalled approximately 20 m for elevation and defined faults with >25 m throw and positional accuracy was to 50 m. (Figure 9.1).

Figure 9.1: An example showing seismic predicted elevations of the VCR sub surface versus the intersected reef elevations through the surface drilling



Source: South Deep CPR 2021

Combined with known structure and surface drillhole information, the VCR surface forms the basis and stratigraphic datum for the development of the South Deep geology and structural model. In 2020, re-processing and re-interpretation of the seismic data commenced utilising industry and academic experts and the latest interpretation algorithms to produce an enhanced resolution of the structural fabric. This project is scheduled for completion in 2021 followed by model updates where warranted. The accuracy of the seismic data is confirmed by surface drilling results, with most of the reef intersections being within 20 m of the modelled depth. The data is currently being processed and modelled. The data from both the seismic modelling exercises will be incorporated in the geological model build for SoW area in H2 2022.

Underground mapping is conducted utilising the recently adopted digital mapping tool Datamine Studio Mapper®. The mapping tool entails the taking of geo-referenced photographs underground, which then enables the digital delineation of geological structures. A significant development with the introduction of the mapping tool is the capturing of geo-referenced sedimentological data, which up until recently was confined to drillhole data. This enhancement will significantly boost the quality and quantity of sedimentological information which in turn will promote robust geozones.

All mapped data is verified by the section geologist and chief geologist before it can be saved into the SQL database. Any significant new information such as an intersection of a seismically active structure or Ventersdorp lava, which represent a geotechnical ground control issue, is communicated the same day informing relevant parties of the intersection. This ensures that mitigating actions are addressed in the shortest possible time.

Underground excavations are mapped after every second blast. Structures mapped underground are delineated by means of yellow paint clearly highlighting their presence in the excavation. The production supervisor is informed during the shift of any structures encountered with particular emphasis on highlighting any risks that the structures pose and the means to mitigate these risks. These structures are then plotted on the underground plans during the shift and again on surface plans used for plotting and planning. A formal geological report follows the next day, and structures updated immediately in Mine CAD®. The latter ensures that the latest information is available for the plotting of plans and generation of survey notes etc.

All mapped data is verified and saved into the SQL database. Geology memos are interrogated to determine the impact of the mapping on the geological model. Any changes made to the geological model are noted on the plan and are used as a reference for the subsequent model build, which also serves as a quality control mechanism.

10 Drilling

10.1 Type and extent

Underground LIB drilling is routinely undertaken at South Deep targeting future mining areas. This is supplemented by grade control drilling, termed 'mine definition drilling' at site, prior to stoping. As noted in Item 9, South Deep does not have actual exploration targets to report in the technical sense but the LIB drilling, designed for resource definition, is classed as exploration drilling in this instance. No surface drilling has been carried out since 2013. All geological drilling is by means of diamond drilling with full core extraction. Bit size is BX with an inner diameter of 42 mm and an outer diameter of 60 mm.

The mine's drilling strategy and standard operating procedure aims to profile the appropriate resource confidence level to support and de-risk the short, medium and long-term mine design and schedules. Three distinct drilling programs are employed, namely:

- Resource definition drilling provides information for medium-term planning and design refinement, and is based on a 60 m – 120 m grid, up to 300 m ahead of the advancing de-stress faces. The drilling is conducted from footwall infrastructure and executed ahead of the advancing de-stress cut echelon.
- LIB drilling attains a 300 m grid, up to 1,000 m ahead of the de-stress echelon. This drilling provides additional data for structural definition, stratigraphic modelling, facies determination and assaying for grade estimation to inform long term planning.
- Infill grade control drilling (also known as mine definition drilling) is the final stage of drilling and data acquisition prior to stoping. This drilling provides infill drilling to the existing resources definition drill grid to achieve an approximate 30 m x 30 m coverage to support long-hole stoping. The data generated is used for local scale facies determination, structural definition, stratigraphic modelling, assaying for resource estimation and detailed stope design for drilling and blasting.
- Cover drilling is conducted simultaneously by means of drilling a series of low inclined cover holes (-30 °) from within the de-stress cut to enhance detail on geological structure. Up to four holes are drilled per corridor up to a depth of 150 m ahead of the advancing cut and will facilitate a series of geophysical surveys for increased geological confidence, and for geotechnical modelling and domaining purposes.

Details of the 2021 LIB and grade control drilling and expenditure is presented in Table 10.1.

Table 10.1: 2021 drilling and expenditure for South Deep

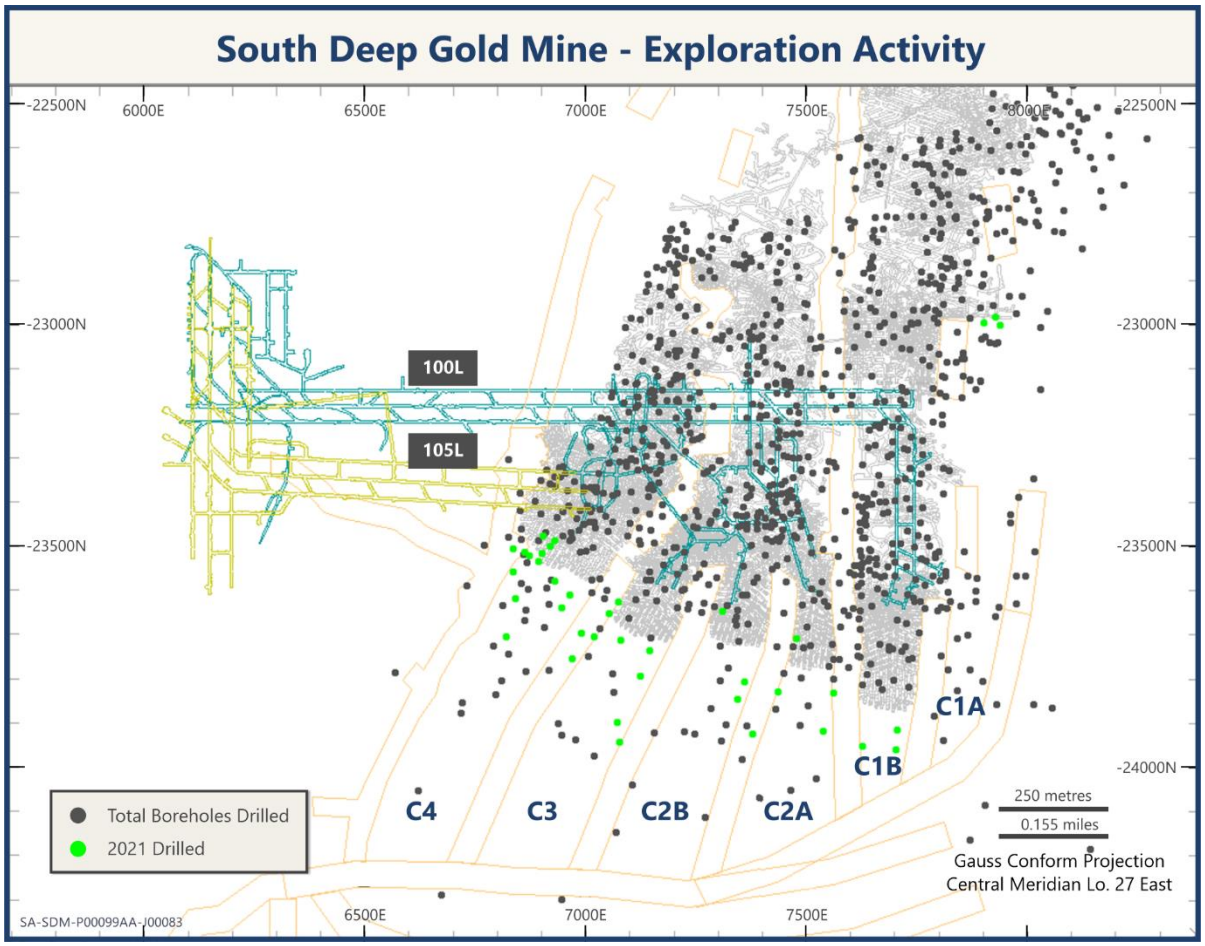
Exploration drilling	For the year ending 31 December 2021		
	metres	R million	$ million
South Deep total	15,025	35.68	2.41
Grade control drilling	11,908	27,55	1.86
LIB and infill drilling	3,117	8,13	0.55
Average 2021 exchange rate: $=R14.79			

Source: South Deep CPR, 2021

The drillhole footprint for the NoW and SoW mine areas is shown in Figure 10.1.

Surface drilling campaigns have provided key information for the development of long-term facies boundaries, structural fabric, stratigraphic modelling and Mineral Resource estimation covering the extensive multi decade life of mine plan. The last major surface drilling program completed in 2013 focused on the SoW area on a nominal grid spacing of 500 m. The drilling results are complemented by the seismic survey data to define the VCR/ Ventersdorp lava contact position, which is utilised as a key stratigraphic datum, and to provide higher definition of other geological features.

Figure 10.1: South Deep North of Wrench and South of Wrench drillhole footprint (December 2021)



Source: South Deep CPR, 2021

Infill drilling of the SoW area by means of LIB drilling from the existing underground infrastructure commenced in 2021 with the aim of assessing the structural and geotechnical integrity of the Wrench Fault and further enhancing geological and grade confidence ahead of mining. The plan entails the deployment of two drill rigs targeting the SoW West and East areas.

10.2 Procedures

Gold Fields has standard procedures in place that describe processes and standards to be maintained in the collection of all sampling data. The standards cover underground and surface drilling and are consistent with the requirements of resource-reporting codes.

Prior to logging, the Geologists apply the normal QAQC protocols pertaining to core cleanliness, packing and the depth markings. As part of the logging process, the geologist defines the stratigraphic horizons by generating a cross section plot of the hole trajectory against the geological model to understand what is expected. The reef and lithology of the drill core is captured directly into Fusion database® utilising Datamine DH Logger®.

The survey methods used at South Deep comprise normal survey traverses, free surveys through resections, and void measurements through electronic scanning. All holes are also down hole surveyed by an independent service provider utilising electronic multi-shot or gyro survey instruments. All underground boreholes are surveyed using electro magnetic survey (EMS) and gyro (non-magnetic) instrumentation. All EMS tools are roll tested before and after each

survey. Tools are original equipment manufacturer (OEM) calibrated quarterly for accuracy assurance. Drillhole collars are marked out pre- and post-drilling by South Deep mine surveyors.

Survey accuracies are bound by legislation, and the survey plans were audited by the DMRE in 2020. All surveys refer to the Lo27 Cape datum (Clarke 1880 modified spheroid) for South Africa. The borehole collars are surveyed by the mine surveyors and the collars are captured in the borehole database. All surface surveys are based on the farm beacons with elevations below datum and co-ordinates supplied by the DMRE. Datum is 1,828.797 metres above mean sea level.

The core is packed in closed, fit-for-purpose core boxes underground that are labelled accordingly and sealed and transported in a closed vehicle to the core yard located on surface. The core is logged on surface in the core yard. The core is generally not oriented. Sampling is by whole core and no core splitting is conducted currently.

The following QAQC controls are practiced with respect to the core:

- The core boxes from underground are laid out according to the labelling of the boxes ensuring the correct sequence is followed.
- The core is then cleaned utilising degreaser.
- The core is then carefully unpacked from the underground boxes to the permanent core boxes in the core yard ensuring that each piece of broken core fits.
- The core is then marked taking into account the depth markers.
- Standard logging conventions (lithology, sedimentology, structure and facies) are used to capture information from the drill core. Most of the observations are captured electronically using Toughbooks.
- Core loss is also recorded in the database and some loss occurs locally when drilling through fault/shear zones which may be not very competent.
- Density may also be measured and recorded in the database for specified samples.
- This ensures that there is no material impact on recovery and sampling.

All the core is individually scanned (photographed) per core box by the geologist and the information stored in the borehole Fusion database®.

The Qualified Person's opinion of the 2021 LIB, resource infill and mine definition drilling is:

a) All drilling activities are supervised to ensure health and safety and maintain appropriate technical standards.

b) The drillhole surveys are adequate by type and length for the intended purpose.

c) Orientated core is not necessary in most cases due to the nature and geometry of the orebody.

d) The drillhole database and subsequent modelling aligns to core recovery losses and should not cause material errors.

e) Post QAQC screening and validation drillhole results are incorporated into the estimation of Mineral Resources; the categorisation of Mineral Resources is described in Item 14.

f) Validated drillhole results are used in the 31 December 2021 Mineral Resource estimation.

g) Individual LIB, resource definition and mine definition drillhole results are not viewed as significant or material to the Mineral Resource and Mineral Reserve reporting at South Deep and consequently this data is not presented.

11 Sample preparation, analyses, and security

11.1 Sample preparation

All borehole lengths are corrected to reflect the true hole length for 2D plots and interpretations. Collars are surveyed and validated against survey voids prior to sampling. If the geometry of the mineralisation with respect to the drillhole angle is known, its nature is reported. Sample lengths are between 0.5 m to 1.0 m for underground boreholes, and 150 mm to 300 mm for surface boreholes honouring the stratigraphic boundaries.

A sample must not straddle a stratigraphic contact hence it is important to include 20 mm of quartzite waste (either in the hangingwall or the footwall) into the reef horizon to ensure that mineralisation on the contact is included in the reef sample. A sample ticket (ID) is attached at the top right-hand corner of the bag in-between the folded over portion and staple the ticket to the bag. The sample IDs are then captured into the Fusion database® through DH logger® (data capturing software). Upon completion of the bagging process, a list of samples is extracted from the Fusion database® and compared to the physical samples for verification. This list is signed by a Senior Geologist and geological database manager prior to dispatching the samples. The samples are collected by the laboratory twice a month on average. Surface drillholes from the brownfield exploration which was completed in 2013 were split, and the duplicates are kept at the Oberholzer Geological Centre in Carletonville. LIB holes and mine definition (grade control) holes are whole core sampled. Rejects are despatched to the gold plant and treated with run-of-mine ore.

The Qualified Person has reviewed the sample preparation and security procedures. The sample preparation is found to be adequate with effective supervision and in line with industry leading standards. No material bias is indicated that could potentially impact the sampling preparation and analysis. Sample security enforcement is reliable with low consequence if in the unlikely event of security protocols failure.

11.2 Sample analysis

Most samples are assayed by SGS Laboratory (SGS) in Randfontein (accreditation number T0265 and registration number 1996/001447/07) and Mintek (accreditation number T0042 and registration number (N/A – State-owned enterprise) is used as an umpire laboratory. The umpire laboratory is used to give independent verification of the primary laboratory's results.

Samples sent to the SGS laboratories are analysed by the following methods:

- Gold (g/t) is determined by fire assay with an atomic absorption finish (FAA303) and for low level (ppb) Au (FAI515).
- Uranium or U3O8 (ppm) is determined by pressed pellet with an X-ray fluorescence (XRF) finish.

These are standard, industry wide analytical methods.

The current contract with SGS contains detailed instructions concerning the treatment of the South Deep samples and are checked with QAQC meetings and regular laboratory audits undertaken by both Gold Fields staff and by external auditors as required. The contract specifies requirements including grind size checks, duplicate analyses and sample handling.

On arrival at the laboratories, the samples are sorted, checked against the accompanying documentation, weighed and barcoded sample tickets are scanned to enter sample numbers into the Laboratory Information Management System (LIMS). Barcoded sample labels and work sheets are used to control the workflow through the sample preparation and analytical phases.

The samples are dried at 105˚C and crushed in a Rocklabs Boyd jaw crusher at a nominal top size of 90 % passing 2 mm. The crusher is fitted with a sample rotary divider that automatically splits the sample in two.

A 1 kg sample is selected for pulverising while the coarse reject is returned to South Deep. Pulverising is by Labtechnics LM pot mills to a nominal top size of 90 % passing 75 µm. around 5 % of the samples are taken for screen analysis and reported to the mine monthly.

A 30 g sample aliquot is placed into crucible with an appropriate amount of lead oxide flux. Silver is added to ensure the prill obtained is large enough to handle. To avoid sample swaps, copper sulphide is added during the process to selected sample(s) to assist in maintaining and tracking the sequence of samples. The crucibles are heated in a furnace at 1,100 °C for an hour. The molten material is poured into moulds and the lead button containing the gold is separated from slag by hammering of the button. The lead button is then transferred to the preheated cupels and placed into the cupellation furnace at 960º C. The resulting prill is digested in test tubes with a solution of aqua regia. The resulting solution is analysed for gold using an atomic absorption spectrometer (AAS).

Uranium is determined by pressed pellet with an XRF finish. A 20 g sample is mixed with Sasol wax, which is used as binder in the pressed pellet. The method comprises two consecutive pyro-chemical separations. The pulverised product (30 g sample aliquot) is fused with a suitable flux under reducing conditions, which promotes the separation of the precious metals from the gangue, with simultaneous collection as a lead alloy.

The lead is subsequently removed by oxidising fusion (cupellations) and the precious metals (gold) are then available for measurement. Bullion correction aimed at correcting fire assay gold values for silver content is also carried out and continuously monitored.

The Qualified Person has reviewed the certificates and is of the opinion that the analytical laboratories are certificated and have effective process and protocol in place to ensure QAQC and minimize any material errors.

11.3 Quality assurance and quality control (QAQC)

All drillhole samples undergo rigorous QAQC checking. This takes the form of certified Au and U_3O_8 standards being inserted at regularised 10 sample intervals to conform to the batch size utilised at the laboratory. Blanks are used to check for contamination during the sample preparation phase at the laboratory, whilst repeat samples are used to check assay accuracy and precision. Repeat assays, in-batch duplicates, umpire laboratory programs and precision analysis are used to ensure that the laboratories adhere to assay standards and protocols. The QAQC procedures exist for underground sampling and drillhole sampling systems.

Quarterly laboratory audits and planned task observations are some of the other QAQC procedures used to ensure sampling protocol is maintained.

A detailed QAQC report is compiled quarterly by the mine and it is followed up by quarterly audits of the laboratory. The aim of the audit is to measure and report on the performance of the assay laboratories regarding precision and accuracy of Au fire assays and U_3O_8 XRF analysis. Any issues found are tabled and discussed with management of the laboratory and measures are taken to address and prevent repeat incidents. All geologists receive training in QAQC and are expected to actively monitor and maintain the quality of the data they are producing. Data collection and storage is subject to internal system and staff-based controls and auditsunderpinned by the Group’s embedded risk control matrix (RACM). including, controls and audits, round robin laboratory analysis and QAQC reference material usage.,

The QC samples are submitted within laboratory batches allowing monitoring of the drilling, sampling, laboratory sample preparation techniques as well as analytical accuracy and precision. The different types of QC samples are summarised in Table 11.1.

Table 11.1: Quality control sample types

Sample description	QC stage	Comments
Coarse crush duplicate	Preparation after jaw crush, but before pulverized	Rocklab RM2000 Machine is used.
Laboratory duplicate	Preparation	The lab system selects the lab duplicates randomly.
Standard/blank	Analytical	The blank is used as the first sample and then followed by a standard after every 9th sample.
Pulp re-assay	Analytical	If the standard or blank fails then the entire batch of 18 samples (9 samples below and above the standard/blank) will be sent back for re-assay.
Pulp umpire	Analytical (at the end of a program)	10 % of the quarterly pulps is sent to umpire lab (Mintek) for accuracy.

Source: South Deep CPR, 2021

12 Data verification

The execution of the various mine drilling programs described in Item 10 has been completed to industry leading practice and is aligned with numerous international standards. The process consists of procedures, audits and sign-off documents for all key elements that input into the generation of a Mineral Resource model to ensure technical assurance and full compliance. The key components of the geological data acquisition framework include:

- Validity – Controls to ensure the validity of key activities.
- Accuracy – Controls to establish the accuracy of data inputs and outputs.
- Completeness – Controls to ensure the completeness of the process followed.
- Timing – Preventative and detective controls to identify potential risk and deviation of quality.
- Segregation of duties/sign-off – Key members of the senior team are responsible for different aspects of the process.

The Qualified Person is of the opinion that the data verification process and protocols are adequate to minimise any material errors, are in line with industry leading standards and underpin the technical assurance and validity of the sampling results.

12.1 Data management

The primary sources of data used for the determination of Mineral Resources and Mineral Reserves at South Deep include:

- Drillhole information.
- Geological mapping and geophysical information.
- Sampling and assay information.
- Survey measurements.
- Specific gravity data.

Collected data is continuously validated and checked by the various supervisors and/or Heads of Department with ultimate verification and approval residing with the Head of Department. All primary sources of data are stored in electronic format, and the data is stored on the mine IT server in the relevant systems databases. All updates to data files are backed up on a regular basis, with a complete backup done on a weekly and monthly basis to ensure off-site security and data recovery. The secondary storage of data resides off site at Sandton, Johannesburg.

Once a hole is logged, sampled and has passed assay QAQC, a checklist comprising 25 items is signed-off by the Database Administrator, Chief Geologist and Chief Resource Geologist. All applicable hardcopies are printed with the checklist and filed.

All assay results are verified by the responsible geologist with the logging data. Data transfer is authorised by the Chief Geologist. Sample data is imported electronically into DH Logger® and automatically exported to the Fusion Database® and seamlessly into Datamine®. Detailed information for each drillhole is also stored in hardcopy in the Database Co-ordinator Geologist's office.

Upon acquisition of South Deep by Gold Fields in 2007, the Geology Department had inherited a substandard drillhole database, with logging and sampling data stored in Excel spreadsheets. In 2016, the stratigraphy was expanded from 6 to 16 stratigraphic units to significantly enhance orebody resolution and granularity prompting a retagging of old drillholes. To this end, the Geology Department has:

- Acquired and set up a drillhole SQL database with a Fusion Database® and DH Logger® front end.
- Resolved issues from various Excel spreadsheets and imported the data into Fusion Database®.
- Verified all drillhole and sampling data against hardcopies.
- Enabled the Mineral Resource Department to extract data directly from Fusion Database® for estimation.

A Datamine® dataset is used for the generation of the geological model and is independent of the drillhole database so any edits affected to the drillhole by virtue of the model build process are not automatically filtered through to the drillhole logs and are manually revised.

The Qualified Person's opinion of the data management is:

a) The data management process and protocols are adequate to minimise any material errors.

b) Regular validation of the database and data management process is aligned with standard industry practices, and is monitored through the risk control matrix RACM.

12.2 Drilling

See Item 10.2 for relevant details

12.3 Sampling

See Item 10.2 and Item 11 for relevant details.

12.4 Survey

See Item 10.2 for relevant details.

12.5 Sample analysis

See Item 11 for relevant details.

12.6 Bulk density

South Deep has a program in place for measuring in situ specific gravity (SG) of all reef horizons using the water immersion method. Bulk density measurements are routinely completed by experienced South Deep core farm staff utilizing the water displacement method for competent non-porous rocks. One drillhole per month is analysed with the objective of being as representative as possible of the orebody. Measurements are conducted on site by the sampler and involves the measurement of the weight of the sample in air and the weight of the sample in water. This variance is then used to determine the SG of the sample and is done for each sample selected for assay per selected drillhole. An aluminium rod with a known SG is used routinely at ten sample intervals for calibration as part of the QAQC program.

At present, the database contains a total of 17,555 readings with an average SG of 2.71 t/m^3.

12.7 Geological modelling

Geological interpretation has the potential to impact materially on the estimated quantity and quality of a Mineral Resource and Mineral Reserve and assumptions regarding volume and geological and/or grade continuity are important to support the correct estimate of contained metal. Support from expert geologists, site and corporate peer reviews, external reviews, and the Model Change Authorisation (MCA) process ensure that the geological interpretation is one that would be universally supported and independently arrived at.

The Qualified Person's opinion of the geological modelling is:

a) The geological modelling protocols are adequate to minimize material errors.

b) The controls have been reviewed and the adequacy is reasonable and that material bias or errors are unexpected.

c) The systems to reduce human and procedural errors, checks and balances are adequate and minimize material errors.

d) The protocols are adequate as reviewed and that the Mineral Resource models are based on sound data and are reasonable.

Planned Task Observations (PTOs) are conducted monthly encompassing underground mapping, logging, and sampling with only minor operational issues identified during the course of the year. An external extensive audit was conducted by Shango Solutions and Optiro in 2016 and SRK Consulting (SRK) in 2020 covering the entire value chain in geology from data capture to data processing and storage and ultimately the quality of the geological 3D model, estimation model, resource reporting strategy and Mineral resource declaration. The findings were limited to recommendations for continuous improvements with no significant issues, fatal flaws or non-compliances identified. Internal technical reviews are scheduled annually by the CTS team to support the external and independent audits.

13 Mineral processing and metallurgical testing

13.1 Testing and procedures

13.1.1 Background

The South Deep operation mines ore from the VCR and Upper Elsburg reef, which were first intersected in the early 1950s.

With respect to geology (see Item 7), the South Deep orebody consists of a series of planar meta-sedimentary auriferous and uraniferous palaeoplacer deposits associated with the Witwatersrand Basin of South Africa with pyrite being the dominant gangue heavy mineral.

The current South Deep gold plant was commissioned in 2002 in line with the decommissioning of the previous South Shaft plant. The present plant was further upgraded in 2012, with the addition of a second ball mill, to supplement the existing milling circuit, along with additional gravity concentrators and leach tanks, increasing nameplate capacity to approximately 4 Mt per annum. The plant's milling circuit operates on an ad-hoc campaign basis and below nameplate capacity, dependent on the supply rate of crushed underground ore.

In addition to processing ore mined underground, the process plant is currently re-treating tailings material from the decommissioned TSF 1 and TSF 2 associated with the original process plant at South Shaft, with the main purpose of ensuring a consistent source of plant tailings for underground mine hydraulic backfill to provide ground support for the mined voids. However, although gold is recovered as a by-product of the backfill process from a dedicated CIL circuit these tailings are not included as Mineral Reserves (refer to Item 1.4 and Item 1.5), and therefore discussion of associated metallurgical testing and performance in this section is not included.

Metallurgical performance estimations for the Mineral Reserve life of mine forecasting are based entirely on actual performance of the current process plant. Relatively recent (2011, 2012 and 2017) testwork has been undertaken for the purposes of supporting these plant performance estimations.

Recent Mineral Reserve metallurgical testwork consists of the following:

- **NoW** – Two gold and uranium deportment studies were undertaken on samples collected from the Upper Elsburg (95 Level), undertaken by SGS South Africa, Johannesburg, South Africa.
  - 2011 - Eight samples from the 95-3W (proximal portion) area
  - 2012 – Eight samples from the 95-2W (mid fan portion) area
- **SoW** - Metallurgical testing on four composite samples from the SoW area, undertaken in 2017 by Mintek, Randburg, South Africa.

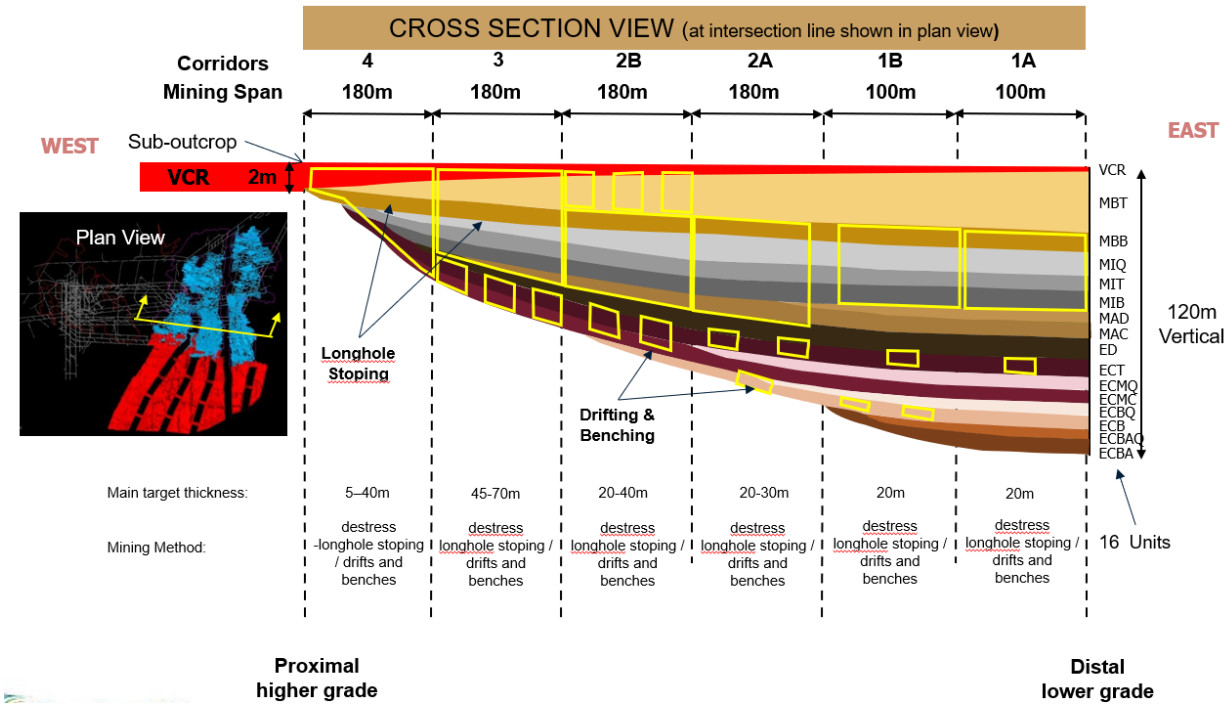
The testwork scope and results from these programs are discussed in Item 13.2.

13.2 Relevant results

13.2.1 North of Wrench (NoW)

The sample selection for the NoW area metallurgical testing was to provide separate metallurgical response assessments of the different economic components of the Upper Elsburg multiple stacked reefs or units. This economic horizon is made up of the Upper Elsburg Individuals (Waterpan Member) and the Upper Elsburg Massives (Modderfontein Member) as illustrated in Figure 13.1. The Upper Elsburg Individuals – or EC/ED unit – consists of four well-defined conglomeratic units, separated vertically from each other by more poorly-developed conglomeratic zones and immature quartz wackes.

Figure 13.1: Geological schematic through South Deep orebody



Source: South Deep CPR 2021

The reefs themselves exhibit widely varying lateral facies changes. The names of the reef bands or horizons occurring within the EC unit are, from bottom up:

- EC Basal Band (ECBA)
- EC Bottom Band (ECB)
- EC Middle Band (ECM)
- EC Top Band (ECT).

The EC unit is separated from the overlying Upper Elsburg Massives (Modderfontein Member) by a well-defined quartz wacke known as the ED unit. The Upper Elsburg Massive reefs also consist of four conglomeratic packages with widely varying lateral facies definitions. The reef bands or horizons making up the Upper Elsburg Massives, from bottom up, are:

- Modderfontein A Conglomerate (MAC)
- Modderfontein Intermediate Bottom Band (MIB)
- Modderfontein Intermediate Top Band (MIT)
- Modderfontein B Bottom Band (MBB).

The scope of the SGS 2011 and 2012 gold and uranium deportment (nature and occurrence) studies included:

- Detailed (multi-elemental) head assays.
- Size-by-size gold and uranium analyses.
- Heavy liquid separation and mineralogy.
- Gravity recovery testing.

- Direct cyanide leaching.
- Diagnostic leaching.

A summary of the key test results is shown in Table 13.1, and the relationship between the sample's head grades and leach recovery results is shown in Figure 13.2.

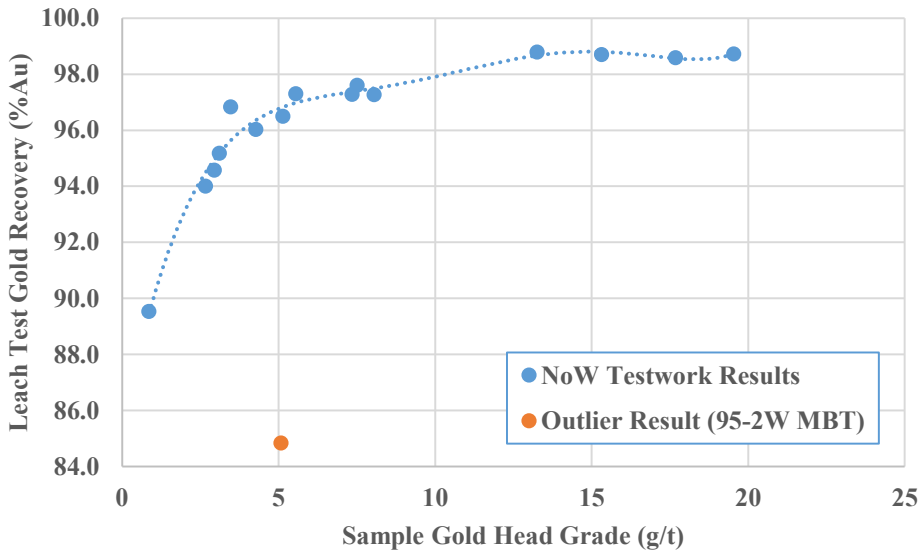
Table 13.1: North of Wrench gravity / leach testwork results summary

Sample ID	Silver (ppm)	Total Sulphur (%)	Uranium (ppm)	Calculated gold grade (g/t)	Gravity recovery(1) (%Au)	Leach tails gold grade (g/t)	Leach recovery(2) (%Au)
95-3W							
ECBA	<1	1.77	83	5.14	64.88	0.18	96.5
ECB	<1	1.55	61	5.55	77.68	0.15	97.3
ECMC	<1	1.64	65	3.11	65.92	0.15	95.2
ECT	2.2	1.54	60	13.26	79.76	0.16	98.8
MAC	<1	1.81	86	7.35	77.76	0.20	97.3
MBB	2.4	1.90	81	17.68	71.91	0.25	98.6
MBT	3.3	2.53	81	19.54	63.11	0.25	98.7
MIT	1.8	1.66	68	15.32	82.23	0.20	98.7
95-3W Ave.		**1.80**	**73**	**10.87**	**73.18**	**0.19**	**98.2**
95-2W							
ECBA	1.43	2.67	99	7.51	66.15	0.18	97.6
ECB	1.17	2.27	86	2.95	88.24	0.16	94.6
ECMC	1.6	2.28	91	4.28	63.78	0.17	96.0
ECT	<1	1.34	33	2.67	78.57	0.16	94.0
MAC	1.57	1.7	97	3.47	82.26	0.11	96.8
MBB	1.37	1.62	55	8.05	86.21	0.22	97.3
MBT	1.7	3.00	108	5.08	60.74	0.77	84.8
MIT	1.87	1.98	63	0.86	94.24	0.09	89.5
95-2W Ave.		**2.11**	**79**	**4.36**	**74.82**	**0.23**	**94.7**

Notes: 1. 3" Knelson concentrator used, grind P_{50} of 75um, ~2.7 % to 2.9 % mass pull to concentrate
2. Leach test using 5 kg/t NaCN, 20 g/ℓ activated carbon, pH 10.5 to 11, grind P_{80} of 7 5um

Source: South Deep CPR 2021

Figure 13.2: North of Wrench testwork results – grade versus leach recovery relationship



Source South Deep CPR 2021

The gold deportment and metallurgical test results indicate that the 95-3W (proximal portion) and 95-2W (mid fan portion) areas of the NoW domain exhibit broadly similar characteristics including:

- Very high silica (SiO2) content at approximately 88 % to 93 % being predominantly quartz.
- Significant enrichment in sulphur, pyrite the predominant sulphide mineral.
- Low organic carbon and copper concentrations mitigating the risk of preg-robbing and high cyanide consumption that could impact the metallurgical recovery of gold.
- High amenability to gravity separation supported by heavy liquid separation (HLS), gravity separation results and the presence of coarse gold.
- Liberation and exposure study results supporting gravity separation and high leachability potential.
- High cyanide solubility at 85.1 % to 98.8 %, albeit at the high-test cyanide concentration used (5,000 ppm).
- 14 out of 16 samples indicated >94 % cyanide solubility at the test grind size of P80 of 75um.

13.2.2 South of Wrench (SoW)

Metallurgical testwork was carried out on four drill core composites from SoW with the following scope items:

- Detailed (multi elemental analysis).
- Knelson gravity recovery.
- Gold cyanidation of the gravity tails.

The sample selection approach for the SoW samples was different to that used for the NoW samples. Instead of sampling the individual reefs, sample selection was based upon spatially located mining sections, that intercepted multiple reefs that existed at the specific cross-section location.

A summary of the results is shown in Table 13.2.

The gold head grade of the four drill core composite samples ranged from 1.1 g/t to 6.4 g/t. The samples achieved gravity recoveries ranging from 48.1 % to 61.8 %. Three out of the four samples had final solids residues with gold grades below the analytical method's detection limit of 0.008 g/t, indicating very high cyanidation leach recoveries.

These results are unusual with the very low assayed leach tailings grades, so they have not been used for Mineral Reserves determination or plant performance forecasting. From a geological perspective, it is considered by geologists, that the SoW ores are geologically fundamentally like those from the NoW area.

Table 13.2: South of Wrench gravity / leach testwork results summary

Sample ID	Calculated gold grade (g/t)	Gravity recovery[1] (%Au)	Leach recovery[2] (%Au)	Leach tails gold grade[3] (g/t)
KNF-8	1.00	48.1	98.7	0.013
DP-25	2.78	53.8	99.7	<0.008
DP-24	6.40	61.8	99.9	<0.008
DP-19	2.94	59.7	99.7	<0.008
Average	**3.28**	**58.6**	**99.7**	**0.009**

Notes: a) 3" Knelson concentrator used, grind P_{50} of 75 um, ~0.8 % to 1.4 % mass pull to concentrate
b) Leach test using 1,000 ppm NaCN, pH 10-11, grind P_{80} of 75 um
c) Tails grades below detection limit of 0.008 g/t are assumed and averaged as 0.008 g/t

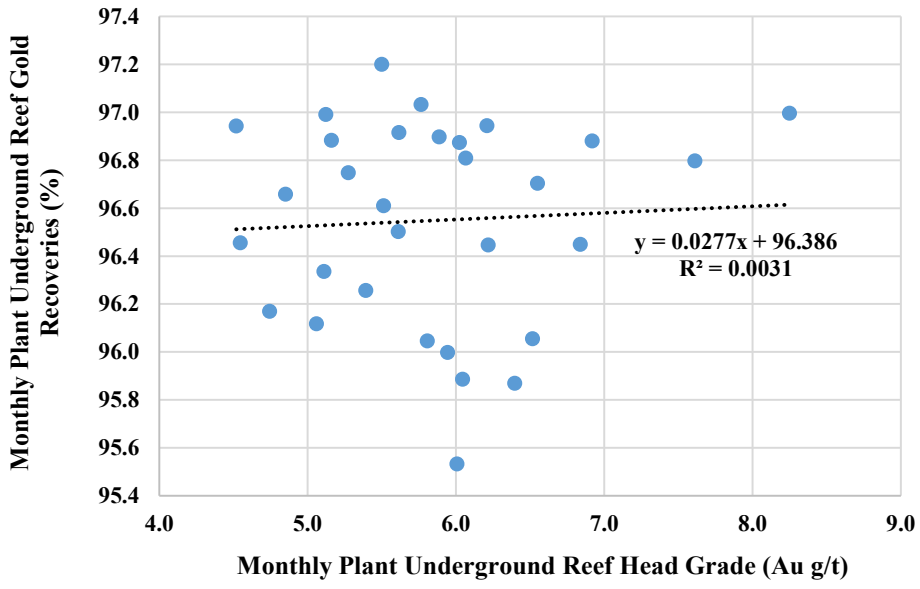
Source: South Deep CPR 2021

13.2.3 Process plant metallurgical performance

The underground reef monthly plant feed grades and metallurgical recoveries achieved are shown in Figure 13.3 for the period January 2019 to September 2021. Table 13.3 shows that there is no strong relationship between the plant feed grade and metallurgical recovery for the reef ores identifiable at the relatively limited grade range (4.5 to 8.5 g/t), as fed to and processed by the plant.

For the life of mine Mineral Reserve modelling and gold sold for the cash flow calculation, the assumed metallurgical recovery for the Upper Elsburg reef ores is 96.5 %. This metallurgical recovery is based on recent plant performance, with 96.2 %, 97.0 % and 96.4 % recoveries being achieved in 2019, 2020 and 2021 respectively for underground run-of-mine.

Figure 13.3: Monthly plant underground reef gold



Source South Deep CPR 2021

For Mineral Reserves cut-off grade determination, a plant recovery of 96.5 % recovery is assumed.

The nameplate of circa 4.0 Mt per annum capacity of the plant exceeds the capacity of the underground mine to deliver ore. The milling circuit currently operates at reduced throughput and on a campaign basis, associated with supply of crushed ore from the underground mine. The current plant was designed based upon pilot plant testing of underground ore samples (Mintek, 2000) and using the ore characteristics shown in Table 13.3.

Table 13.3: Plant ore hardness characteristics used for design

Ore specific criteria	Unit	Value	Source
Work indices			
Rod Work Index, RWI – Design	kWh/t	20.7	Testwork
Ball Work Index, BWI – Design	kWh/t	16	Testwork
Crushing Work Index, CWI – Design	kWh/t	21.2	Testwork
JK drop weight parameters			
A		66.43	Testwork
B		0.88	Testwork
Ta		0.35	Testwork
Rock specific gravity, SG	t/m³	2.7	Testwork

Source South Deep CPR 2021

The recent performance of the South Deep process plant is provided in Table 15.1 for comparison.

13.3 Plant sampling and reconciliation

Plant feed tonnage is measured via a weigh scale (weightometer) on the mill feed conveyor. Plant feed is sampled for moisture determination. Leach feed and residue samples are taken collected using two stage automatic samplers. In certain cases, hand cut samples are collected. Shift composites are accumulated and prepared in accordance with site-specific procedures.

An external South African National Accreditation System (SANAS) accredited analytical laboratory is contracted for carrying out the process plant sample analysis. This laboratory is situated at the Driefontein Complex of Sibanye in Gauteng province. The samples undergo preparation and analysis by slurry pressure filtration (to separate the solids and solution), solids oven drying, splitting, pulverisation, weighing, fire assay and for solutions di-isobutyl ketone (DIBK) extraction and AAS reading.

Laboratory QAQC checks are carried out at the SGS laboratory in Randfontein and Mintek in Randburg, South Africa.

In accordance with Gold Fields Plant Metal Accounting Standard, a gold in circuit inventory is undertaken monthly to reconcile (by mass balance) and compare the back-calculated gold grade of the mill feed with the mill feed grade estimates obtained using daily plant samples and assays. The monthly variance between the assayed grade and the reconciled grade is monitored, and an investigation is initiated if this variance exceeds the minimum allowable levels outlined in the Gold Fields Plant Metal Accounting Standard.

13.4 Deleterious elements

The testwork procedures include analysis for elements that could be deleterious to plant recovery (e.g., arsenic, tellurium, antimony and organic carbon). However, to date no specific deleterious mineral species have been identified that significantly and consistently influence gold recovery estimates. The orebody metallurgical samples tested, do contain elevated sulphur and uranium.

The uranium concentrations are not sufficient to be problematic, or at grades that are economically viable for recovery. Some background copper concentrations occur, however, they are at grades that are not problematic to cyanidation.

13.5 Metallurgical risks

In the opinion of the Qualified Person, the combination of a well-established process plant with a known operating history of treating ore mined from the associated mining areas, together with the recent metallurgical testwork programs, assessing core samples selected from future local mineralisation areas (as outlined in the previous sections), provides a reasonable basis for estimating the associated metallurgical and processing Modifying Factors underpinning the South Deep 2021 Mineral Reserves.

Given the long life of mine with a circa 80-year life of mine plan, some key potential areas of risk and uncertainty remain, which are discussed in the following sub-sections.

13.5.1 Sample representativity

Metallurgical sample selection is an important aspect of the process of developing Mineral Resources into Mineral Reserves. The results of the testwork undertaken on those samples are often used directly as input into plant performance estimates that are then used for the life of mine and Mineral Reserve financial evaluations. It is important that the metallurgical samples are representatively selected, for example, to cover a suitable range of gold head grades, to consider the different geological lithologies and domains expected to be encountered, and to appropriately incorporate internal and external material dilution expected during the mining process. Individually testing different head grades ranges and geological domains improves the ability to see the metallurgical response variability of the orebody, which improves the ability to make better judgements and estimates about how the material could perform in the process plant.

Whilst effort and care are taken with the sample selection process, there are practical constraints to samples numbers due to core availability and testwork cost, and therefore it is not possible for the Qualified Person to guarantee that the proposed Mineral Reserves have been fully representatively sampled, and therefore some inherent uncertainty will remain.

The metallurgical recovery estimation models used for current Mineral Reserve estimation at South Deep were developed using recent plant performance (rather than metallurgical testwork results), as discussed in Item 13.1 and Item 13.2.

13.5.2 Deleterious elements

The historical metallurgical testwork programs include basic head analysis and mineralogical analyses to check for the presence and quantities of potential deleterious elements to the plant, such as uranium, arsenic, organic carbon, base metals, etc.

Whilst this assessment is carried out on the limited number of metallurgical composite samples, it is not typically undertaken on individual drillhole or underground samples.

The multi-elemental assay results obtained from the metallurgical samples are used as a guide to identify if there are any deleterious elements at concentrations that would be of reasonable concern that could materially impact plant performance. If such a species is identified then the option to submit a larger number of individual drillhole or underground samples for detailed analysis, to better quantify and locate the deleterious species, is readily available.

However, with the relatively low number of metallurgical samples checked for deleterious elements means that some inherent risk remains of unexpectedly encountering such a species during subsequent mining and processing operations, despite such elements not being identified during metallurgical testing.

14 Mineral Resource estimates

South Deep's Mineral Resources undergo an initial assessment through the application of a range of assumed technical and economic factors to ensure reasonable prospects for economic extraction.

14.1 Mineral Resource estimation criteria

14.1.1 Geological model and interpretation

Geological models are based on all available structural, grade and sedimentological data. The structural data is used to generate 3D models whilst the sedimentological, gold and channel width data is used to delineate local facies zones. The facies zones are used to constrain the statistical and geostatistical analyses that form the basis of the Mineral Resource estimation process. The geological models are updated on an ongoing basis as new data becomes available. Detailed peer reviews of models and changes are completed on an annual basis by regional and corporate technical consultants.

All mapping and drillhole data is stored in the Fusion® Database. The geological models are generated and evaluated in Datamine® and Leapfrog® proprietary software. Due to the geometry of the mining access and method, it is difficult to drillholes perpendicular to the orebody. Recent holes in the NoW area are drilled at a sub optimal flat angle and are corrected for true widths to be more representative.

The average dip and dip directions for both the Current Mine and NoW reefs are 15° and 165° respectively. The correction methodology involves identifying drillholes outside of a 30 per cent tolerance from the optimal reef intersection at 75°, since the reef is dipping at 15°. The selected holes are corrected to an accepted angle of reef intersection using the average angle of intersection of holes around it. This mitigates potential risk relating to important statistics such as the global mean, which serves as a critical input to the simple kriged (SK) estimates.

A structural plan is developed incorporating all faults greater than 2 m displacement. Using the structural plan, a 3D model is developed in Leapfrog®. A reef reference surface is generated within each structural block. To mitigate the subjectivity of the modelling process particularly in areas with low data density, emphasis is placed on the estimation of channel width. Geological surfaces and volumes are represented using wireframes. These are generated through triangulation or interpolation techniques based on intervals selected by the geologist from drillholes.

The Leapfrog® model is imported into Datamine® and verified, ensuring consistent channel widths across structural blocks, all drillholes and mapped strings are honoured, a sound structural framework and general model integrity is consistent with the overall understanding of the orebody. The geological model is reviewed and signed off by on-site technical and corporate office teams and is subsequently used as the basis of the Mineral Resource block model.

The recent introduction of the Leapfrog® cloud-based database has improved the workflows and interaction between the modelling team and enables improved processing of smaller, manageable and individually updateable project portions, which are combined into a singular "Master Model".

All processes are underpinned by the relevant requirements of the Group's embedded risk control matrix (RACM). Block modelling

Gold grade is estimated into 30 m x 30 m x 1 m blocks., which are sub-celled to provide a better fit to the wireframes. The selective mining unit (SMU) is the smallest volume of material on which ore / waste classification is determined. SMU sizes at South Deep are defined according to the planned mining equipment fleet, mining method and mining selectivity, together with the geology and geometry of the orebody. The SMU block size used is based on an assumed mine definition (grade control) drilling grid of 30 m x 30 m. An SMU size of 10 m x 10 m x 1 m is also tested during the post-processing. The methodology incorporates the information effect and change of support correction. The output provides recoverable tonnages, grades and metal content estimates above respective cut-off grades. The post-processed tonnes, grades and metal estimates for specific cut-offs derived for the respective blocks are issued to the Planning Engineers to undertake the operational and life of mine planning and scheduling.

14.1.2 Compositing and domaining

Geological domains (facies) are areas of the orebody that were deposited under similar conditions, while geostatistical domains are areas within a facies zone in which a similar gold grade distribution occurs. Facies and domains therefore provide a geological framework (stationarity/homogeneity) underpinning geostatistical modelling. It is recognised that there is a strong correlation between sedimentological parameters and gold distribution within the Upper Elsburg and VCR sediments.

Sedimentological data is captured in both resource definition and mine definition (grade control) drilling programs and includes parameters which are found to correlate closely with gold grade distribution. These are, in order of precedence:

- Channel width
- Percentage conglomerate
- Average clast size.

Modelling considers both the proximal/distal relationship and fluvial channel morphology within a specific unit. Higher grades are associated with proximal rudaceous phases, while lower grades occur distally to the east of the property.

Spatial plots of grade and sedimentary data are employed to define homogenous areas for each parameter within a defined structural block and unit. The first step is to produce a plot of the raw data to create a reference point for future processing. All raw data is obtained from validated drillhole logs and assays. Histograms and cumulative frequency plots of the raw data determine the optimal intervals for the generation of gridded, classed data plots and contour plans.

The individual sedimentological, gold value and channel width data/parameter boundaries are overlain to define overall geological facies boundaries within a block. The geological facies in each block are compared to those in other blocks and where facies with similar characteristics are identified, they are amalgamated to produce an overall geozone with a unique grade and sedimentary signature. Within each geozone, grades are assumed to be homogenous to constrain the statistical and geostatistical analyses for the Mineral resource estimation. When reconciled, a close resemblance between geozone estimates and actual reef characteristics, including grades, is encountered.

The geological reef wireframes (with top and bottom surfaces) are filled with a block model, thereby providing a volume per reef unit. These individual reef volumes are then added together to calculate a total volume defined within the specified area/perimeter. A bulk density of 2.71 t/m³ is applied to calculate relevant tonnages (Item 12). For the Upper Elsburg the drillhole data is composited to one metre intervals for mineralized zones. The compositing process is optimised to ensure that no part of the drillholes is excluded. Whilst the VCR is estimated and reported on 2D basis.

14.1.3 Top cuts

Top cuts are used to control grade outliers during estimation. Grades above a selected threshold are capped to the threshold, therefore retaining the high-grade nature locally while controlling the influence on the estimation. Basic statistics (e.g., mean, variances and skewness) are calculated for grade, channel width and gold accumulation per domain. For each domain, high-grade caps/cuts are performed for kriging and variograms respectively, based on visual examination of the data distribution on histogram and probability plots.

The kriging top cap values at a determined threshold do not exclude them from the database. The capping is to ensure that extreme values do not influence the kriging estimates, in particular the spreading of high-grade values over a large area where insufficient data support exists. Kriging caps are generally kept to a minimum, with less than 5 % of the data usually capped. The variogram estimation ‘cut’ excludes all values above a certain determined threshold. This is done to exclude outliers in the variogram modelling process. Including these outliers would distort the underlying variability of the data, leading to poor variogram models. At South Deep the range of kriging top-cuts is 9-200 g/t for the respective reefs.

14.1.4 Variography

All grade variography work is done in flattened transformed 3D space. This improves the experimental data search and variogram modelling. For the 2021 Mineral Resource update, the main reefs were either verified or remodelled.

To determine the directions of continuity for the variograms, contour plots are generated for each domain across the 16 reefs found at South Deep. The contour plots are used as a guide for the reef anisotropy. This tool is helpful in choosing optimal directions of variogram continuities within the context of geological understanding.

The variogram long ranges are typically between 150 m and 250 m but can be longer. The corresponding perpendicular variograms are also modelled to determine the exact extent of the search ellipse. The ranges are used to determine the length of the search ellipse. The ellipse are constructed at 15 % more than the variogram range to ensure adequate samples are available for estimation.

Down hole variograms are modelled for each domain across the 16 reef units. These give practical estimates for the nugget percentage, which is incorporated in the 3D variogram. The nugget percentages for conglomerate reefs are typically between 40 and 45 per cent.

The Qualified Person's opinion is that the variographies are a practical reflection of the spatial continuity of the respective mineralisation grades and their application to the geostatistical analysis is adequate to minimize uncertainty and to derive appropriate resource block models for use by the planning engineers.

14.1.5 Grade estimation

Similar to the variograms grade estimation is performed in a flattened space. This provides an improved sample utilisation across the estimation processes, which improves overall block model confidence.

Grade is estimated into 30 m x 30 m x 1 m blocks using simple and ordinary kriging. The 30 m x 30 m x 1 m grade models are sub-celled to provide a better fit to the wireframes. Simple kriging is carried out using all available data within the search radius, but the algorithm treats domain boundaries as soft boundaries and for blocks near the edge of a domain, the search can include composites within a 30 m skin of the adjoining domain (soft boundary). This has the result of reducing the edge effect and therefore reduces any conditional bias and inefficiencies for blocks around the edge of the domain.

Table 14.1 summarises the key Mineral Resource estimation parameters used in the kriging process for the major economic reefs.

The simple kriging model is post processed from a 30 m x 30 m x 1 m selective mining unit.

The post-processing technique is based on the localised direct conditioning (LDC). This is applied in the medium to long term areas of the mine where the drilling data is relatively sparse. The LDC corrects the smoothing effect and provides support corrections.

The final planning models are stored in Data Manager, a secure database with individual password access. The models are available to all relevant departments including long-term planning, short-term planning, drill and blast, survey and geology. The models are updated on a quarterly basis and date stamped for version control.

14.1.6 Model validation

Visual inspection and documented model reconciliation reviews/reporting are the main validation procedures employed. This includes a review of sections and plans where models are checked for proper coding of drillhole intervals and block model cells. Interpolated grades are examined relative to drillhole composite values to ensure that the grades are correctly assigned including:

- Comparison of composite data with block model estimates.

- Global and local biases checks including kriging efficiency, regression slopes, block distance from samples, search volumes and swath plots.
- Review of reconciliation data.

As part of the reconciliation process, physical factors, including dilution and mine call factor are monitored and recorded monthly in alignment with the Group Guideline on reporting mine reconciliation information. These results are used to reconcile Mineral Resource and Mineral Reserve estimates with actual mined tonnages and grades.

Stoping and development is measured monthly to provide an accurate broken ore and gold estimate which is compared to tonnes milled and gold accounted for to provide a mine call factor. Daily reports are generated based on production bookings and utilised to monitor and manage the mines' grade relative to the monthly plan. Belt sampling is also conducted to assist with daily reconciliations between broken grade and head grade. Reports are generated per mining section and per mining activity. Reconciliations for gold and grade are also conducted on a monthly, quarterly and annual basis providing a reconciliation from planned ore to broken ore to mill head feed and finally to metal recovered. The mine reconciliation of gold was 97% for 2021.

Table 14.1: Summary of December 2021 Mineral Resource estimation parameters of major economic reefs

Block-sizes X,Y,Z	Reef	Domain	Parameter	Search dist1	Search dist2	Search dist3	Min sample	Max sample
30301	ECT	3	AU	106	93	5	8	40
30301	ECT	12	AU	75	144	5	8	40
30301	ECT	11	AU	143	193	5	8	40
30301	ECT	7	AU	144	123	5	8	40
30301	ECT	6	AU	57	132	5	8	40
30301	ECT	4	AU	68	85	5	8	40
30301	ECT	2	AU	63	106	5	8	40
30301	ECT	1	AU	69	97	5	8	40
30301	ECT	9	AU	83	135	5	8	40
30301	ECT	8	AU	71	109	5	8	40
30301	ECT	10	AU	72	130	5	8	40
30301	ECT	5	AU	70	105	5	8	40
30301	ECT	5	AU	102	151	5	8	40
30301	MBB	9	AU	103	154	5	8	40
30301	MBB	16	AU	75	171	5	8	40
30301	MBB	15	AU	74	122	5	8	40
30301	MBB	14	AU	87	153	5	8	40
30301	MBB	13	AU	100	147	5	8	40
30301	MBB	11	AU	93	158	5	8	40
30301	MBB	1	AU	95	200	5	8	40
30301	MBB	7	AU	78	209	5	8	40
30301	MBB	2	AU	70	187	5	8	40
30301	MBB	6	AU	85	189	5	8	40
30301	MBB	5	AU	75	158	5	8	40
30301	MBB	4	AU	72	159	5	8	40
30301	MBB	3	AU	67	185	5	8	40
30301	MBB	8	AU	83	171	5	8	40
30301	MBB	12	AU	124	166	5	8	40
30301	MBB	3	AU	103	144	5	8	40
30301	MIT	14	AU	74	169	5	8	40

30301	MIT	8	AU	95	220	5	8	40
30301	MIT	7	AU	110	144	5	8	40
30301	MIT	6	AU	86	210	5	8	40
30301	MIT	5	AU	91	198	5	8	40
30301	MIT	3	AU	76	185	5	8	40
30301	MIT	1	AU	91	177	5	8	40
30301	MIT	4	AU	147	97	5	8	40
30301	MIT	1	AU	101	123	5	8	40
30301	MIT	2	AU	170	191	5	8	40
30301	MIT	3	AU	74	161	5	8	40
30301	MIT	4	AU	74	166	5	8	40
30301	MIT	5	AU	71	208	5	8	40
30301	MIT	9	AU	95	140	5	8	40

Note: * Based on variogram model, varies by domain/reef. The search distances for only the major reefs are shown in the table.

** Based on statistical analysis by domain/reef, varies by domain/reef.

Source: South Deep CPR 2021

The Qualified Person's opinion is that the respective geostatistical estimation methods and the corresponding input parameters are adequate to minimize uncertainty and to derive appropriate resource block models for use by the planning engineers, the inherent uncertainties relating to the Mineral Resource are as documented under the Mineral Resource classification (Item 14.1.9).

14.1.7 Mineral Resource cut-off grades

Cut-off grades are influenced by the operating strategy, Modifying Factors, design and scheduling and certain costs, and are therefore calculated annually in alignment with the Gold Fields cut-off grade guideline.

Underground Mineral resources are evaluated at the cut-off grade estimated for each area using the following formula:

$$\frac{\text{[Mining Costs (ZAR/t) + Process Costs (ZAR/t) + Site G\&A Costs (XAR/t)]}}{\text{[Price x (100 \% - Ad valorem Royalty Rate) – All product related costs] x PRF x MCF x 0.03215075}}$$

Where:

- Mining Costs take account of the mining method and area being mined inclusive of secondary development and sustaining capital.
- Process Costs are inclusive of sustaining capital.
- Site G&A Costs are inclusive of off-site costs directly related to site (e.g., accounting or payroll services).
- Price is the resource gold price per ounce of $1,500/oz) or ZAR750,000/kg.
- The Royalty Rate is 0.5 %.
- All product related costs include management fees and refining costs.
- PRF is the plant recovery factor or metallurgical recovery as a percentage estimated at a grade close to the cut-off grade.
- The mine call factor or the percentage of actual mill produced metal against the claim of metal produced.
- 0.03215075 is the ratio of troy ounces per gram.
- Mining dilution and mining recovery is used to ascertain the cut-off grades from run-of-mine to in situ. In situ is the point of reference for Mineral Resources – The run-of-mine cut-off is diluted and recovered thus applicable to the in situ resource Mineable Shape Optimiser (MSO).

The cut-off grades used for the underground Mineral Resource estimate by area are summarised in Table 14.2.

Table 14.2: South Deep underground Mineral Resource cut-off grades

Area	Mineral Resource cut-off grade (g/t Au) Run-of-mine	Minimum mining width (m)	Mineral Resource cut-off grade (g/t Au) MSO
CM	3.44	5	3.44
North of Wrench	3.44	5	3.44
South of Wrench	3.78	5	3.78
VCR	6.00	0.5-1	6.00

Source: Gold Fields COG Report, 2021

The Mineral Resource cut-off grade is applied to the deposit model as part of the assessment in relation to minimum mining width and reasonable prospects of extraction. Minimum mining width and realistic extraction are assessed using a MSO routine available in Datamine Studio® RM software. This routine generates a series of shapes that relate to a nominated selective mining unit SMU and a minimum width to maintain an average grade within the shape that is above the nominated cut-off grade. MSO shapes are removed where they are judged too isolated and unlikely to be eventually economically extracted. This leaves a contiguous set of shapes. Small amounts of material below cut-off within the boundaries of the contiguous set of shapes are evaluated to determine if they would be extracted as part of a mining sequence.

When close to existing mining areas, a further assessment is made to ensure that material is potentially extractable. Remnant mining areas are coded using a stand-off distance to existing stopes. Mineralisation inside the stand-off zones is not reported as a Mineral Resource except where an engineering assessment has resulted in the design and potential extraction of planned stopes.

All material within the retained MSO shapes above the calculated cut-off grade is judged to have reasonable prospects for economic extraction and may practically include some material below the cut-off grade that is extracted as part of the mine design and sequence to mine the higher grade (above cut-off) material.

Gold Fields conducts an annual review of metal prices for Mineral Resource and Mineral Reserve reporting to monitor any significant changes that would warrant re-calibrating the price deck for strategic and business planning purposes. This review takes into account prevailing economic, commodity price and exchange rate trends, together with market consensus forecasts, including from global industry analysts and financial institutions, as well as Gold Fields' strategy and expectations for the mine operations.

The Mineral Resource and Mineral Reserve gold prices have been selected and justified by the Qualified Person at $1,500/oz per troy ounce (oz) for Mineral Resources and at $1,300 per troy ounce (oz) for Mineral Reserves (life of mine planning and Mineral Reserve techno-economic modelling). This metal price deck has also been reviewed and endorsed by the Company's executive team. For more information on the rationale applied to deriving the Mineral Resource and Mineral Reserve metal price deck refer to Item 19.

The selected Mineral Resource gold price of $1,500/oz is at a 15 % premium to the reserve price with the differential being in general alignment with Gold Fields standard practice for setting the Mineral Resource price. The 15 % premium on Mineral Resources is to provide useful information on the sites resource potential and its impact at higher gold prices and to indicate possible future site infrastructure, permitting, licencing, mining footprint and tailings and waste storage requirements. This information is important to determine the reasonable prospects of economic extraction for the Mineral Resources.

14.1.8 Reasonable prospects of economic extraction

The full range of mining methods and geotechnical considerations were investigated to assess the integrity of the Mineral Resource. All block models were depleted using mining voids and 2D regional pillar outlines. In addition to this, sterilised ground was excluded, as this material has no potential of extraction considering current mining methods and geotechnical restrictions.

The block models were constrained using an MSO for Mineral Resource reporting based on the minimum mining dimensions of 5 m x 5 m x 5 m. The optimiser creates possible mining stopes above the Mineral Resource cut-off grade. Gold bearing material below the cut-off grade is typically from development, de-stress cuts and stope access outside of the resource envelope and is included in the Mineral Resource estimate as “In design material”.

The designed regional pillars are depleted from the Measured and Indicated Mineral Resource categories. The Inferred Mineral Resource areas do not have an associated regional pillar design, so a 35 % discount Modifying Factor is applied based on the adjacent regional pillar footprints. A 10 % discount factor is also applied to the SoW Mineral Resource, to proactively account for local deviations in reef thicknesses between drillholes due to the wide spacing of the data. An additional 10 % loss factor is applied to the VCR reef to account for anticipated geological related losses.

The CM area has been extensively mined, and the Mineral Resource in effect essentially comprises remnants between historic mining excavations. Most of the historic excavations are filled, however, the backfill quality and extent is uncertain. A risk review of the Mineral Resources within this area was conducted to determine prospects of economic extraction, with high-risk resource blocks identified. Blocks directly on top of, below and between filled excavations and areas requiring mining through historic excavations were categorised as high risk. Actual mining of areas with similar properties has been conducted with varying success, and it was regarded reasonable by the Qualified Person to include 20 per cent of the identified high-risk areas into the Mineral Resource to reflect the anticipated conversion rate.

The Qualified Person has concluded that reasonable prospects for economic extraction have been demonstrated through the application of an appropriate level of consideration of the potential viability of the Mineral Resources. These considerations include a reasoned assessment of the geological, engineering (including mining and processing parameters), metallurgical, legal, infrastructural, environmental, marketing, socio-political and economic assumptions which, in the opinion of the Qualified Person, are likely to influence the prospect of economic extraction.

Although all permitting may not be finalised for the circa 80-year life of mine, there is no reason to expect that required permits and licences will not be granted based on existing processes, protocols and governmental jurisdiction.

Wherever the mineral resources are stated as being exclusive of mineral reserves: mineral resources that are not mineral reserves do not have demonstrated economic viability.

14.1.9 Classification criteria

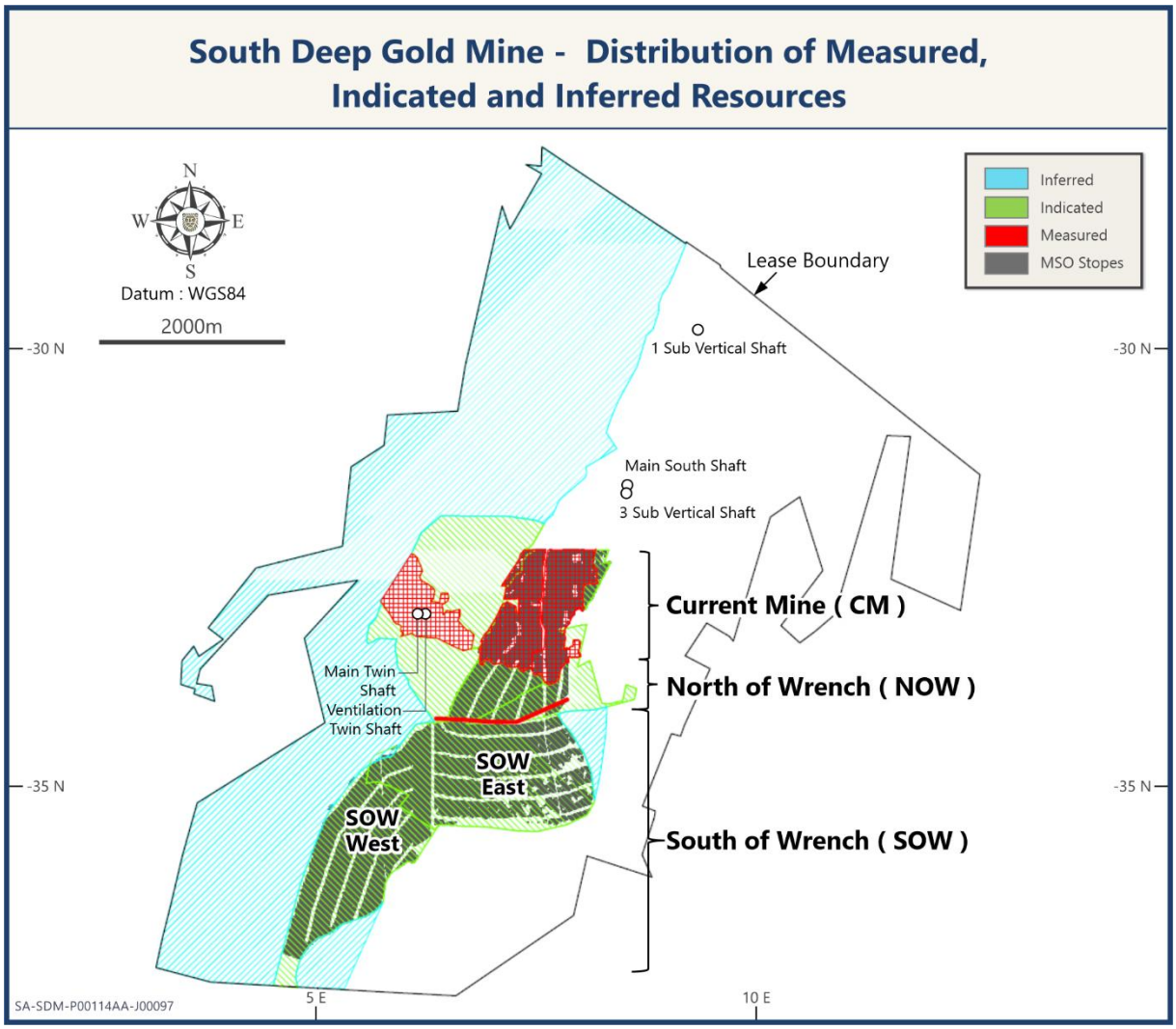
South Deep’s in situ Mineral Resources are classified as either Measured, Indicated or Inferred in accordance with the definitions in the National Instrument 43-101 Standards of Disclosure for Mineral Projects. Only Measured and Indicated Mineral Resources can be modified to generate Mineral Reserves.

Increasing levels of geoscientific knowledge and confidence are generally based on geological understanding, grade continuity, drillhole/sample spacing, sample data quality, estimation quality, physical characteristics, mining development (i.e., amount of exposed and mapped mineralisation) and mining history.

The reefs, which are sedimentary in nature, are laterally strongly continuous with long-range predictability, and reflect extensive intra-basinal fluvial deposits. The classification is a function of the confidence in the whole process from drilling, sampling, geological understanding, and geostatistical relationships (including grade continuity). Classification is dominantly based on geological understanding and drillhole spacing; however, other elements including search volume factors, kriging efficiency, regression slope, structural and grade domain characteristics and underground mapping and development are also considered.

Figure 14.1 shows the distribution of measured, indicated and inferred Mineral resource categories over the South Deep property and mining right.

Figure 14.1: Distribution of Measured, Indicated and Inferred Mineral Resources at South Deep



Source: South Deep CPR, 2021

Measured Mineral Resources are those with sufficient knowledge and confidence on quality, grade, densities, shape and physical characteristics to allow the application of Modifying Factors in sufficient detail to support mine planning and final evaluation of the economic viability of the deposit. It has a higher level of confidence than that applied to an Indicated Mineral Resource or an Inferred Mineral Resource and it may be converted to a Proven or Probable Mineral Reserve. The planned grade control or mine definition diamond drilling must be designed at an approximate 30m by 30m grid spacing, depending on the accessibility for the diamond drill rigs. Due to accessibility underground and other logistical constraints resulting from the production environment, the grid spacing can extend to 60m in limited areas with maximum data projected distance of 90m. The Measured Mineral Resource has comparatively high geostatistical regression slopes and kriging efficiencies from the underlying krig grids and are normally within or close to current mining areas.

Indicated Mineral Resources are those Mineral Resources beyond Measured Mineral Resources where there is sufficient knowledge on quality, grade, densities, shape and physical characteristics to allow the application of Modifying Factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit,

and geological and grade continuity. Indicated Mineral Resources are typically informed by LIB drilling on a 300 m x 300 m grid and in the case of SoW, a nominal grid spacing of 500 m supported by 3D seismic survey data and maximum projected distance of 650m.

The Inferred Mineral Resource is that part of a Mineral Resource for which quality and grade or quality are estimated on the basis of limited geological evidence and sampling. Geological evidence is sufficient to imply but not verify geological and grade continuity. The exact area is defined by a combination of drillhole spacing and geological continuity and characteristics. Inferred resources are declared in areas where the drillhole spacing is greater than 500 m with data projected distance greater than 650m; and/or the geology from the drillholes is anomalous to the general characteristics of nearby areas. It is reasonably expected that the majority of Inferred Mineral Resources could be upgraded to Indicated Mineral Resources with continued resource definition.

The Qualified Person is of the opinion that:

a) Inferred Mineral Resource has realistic chance of converting to Indicated Mineral Resource with continued resource infill and definition drilling, additional empirical data and evolving geoscientific modelling.

b) The Mineral Resource demonstrates reasonable prospects for economic extraction over the indicated study time frame.

c) Routine mine reconciliation monitoring and reporting, on at least a quarterly basis, provides empirical data to endorse the classification criteria applied.

d) The Mineral Resource gold price of $1,500/oz is at a 15 % premium to the Mineral Reserve price with the differential being in general alignment with Gold Fields standard practice for setting the Mineral Resource price. The 15 % premium is to provide information on South Deep's long term resource potential at higher gold prices and to indicate possible future site infrastructure and mining footprint requirements.

14.2 Mineral Resources as of 31 December 2021

The South Deep Mineral Resources exclusive of Mineral Reserves as of 31 December 2021 are summarised in Table 14.3. The Mineral Resources are 90.495 % attributable to Gold Fields based on the economic ownership described in Item 4.5 and are net of production depletion up to 31 December 2021.

The point of reference for the Mineral Resources is in situ with dilution applied through the MSO process.

The Qualified Person's opinion is that, whilst effort and care are taken with the resource estimation and classification processes, increase in geological knowledge and available data will reduce the level of uncertainty, and therefore some inherent uncertainty will remain.

Table 14.3: South Deep - summary of attributable gold Mineral Resources at the end of the fiscal year ended 31 December 2021 based on a gold price $1,500/oz

	Mineral Resources (exclusive of Mineral Reserves)			Cut-off grades (g/t Au)	Metallurgical recovery (%)
	Tonnes/ (kt)	Grades/ (g/t Au)	Gold (koz Au)		
Underground (UG) Mineral resources					
UG Measured Mineral Resources	14,886	6.8	3,236	3.4 to 6.0	96.5
UG Indicated Mineral Resources	69,513	6.5	14,605	3.4 to 6.0	96.5
UG Measured + Indicated Mineral Resources	84,399	6.6	17,840	3.4 to 6.0	96.5
UG Inferred Mineral Resources	20,419	9.1	5,974	3.4 to 6.0	96.5
Surface Mineral Resources (Tailings)					
Tailings Measured Mineral Resources	44,827	0.23	327	0.2	47
Total South Deep Mineral Resources					
Total Measured Mineral Resources	59,713	1.9	3,562	0.2 - 6.0	47 -96.5
Total Indicated Mineral Resources	69,513	6.5	14,605	3.4 – 6.0	96.5
Total Measured + Indicated Mineral Resources	129,226	4.5	18,167	0.2 - 6.0	96.5
Total Inferred Mineral Resources	20,419	9.1	5,975	0.2 - 6.0	96.5

Notes:

a) Mineral Resources are exclusive of Mineral Reserves. Rounding of figures may result in minor computational discrepancies.

b) Surface Mineral Resources are stockpiles contained within historic tailings storage facilities. This material is remined to manufacture hydraulic backfill to support underground mined voids and the gold recovered by a dedicated carbon-in-leach (CIL) circuit, is effectively a by-product of the backfill process and is subsidized in the cost model as it pre-empts the need to source new material for this purpose. Importantly, the Measured Mineral Resource for tailings is not converted to a Mineral Reserve because it cannot report as a Mineral Reserve to generate cash flow in the financial model. The Qualified Person's opinion is that it does meet the reasonable prospects for economic extraction criteria as it contributes to the mining process at a variable cost and is not material to the Mineral Resource disclosure.

c) No year-on-year Mineral Resource comparison is presented as South Deep did not disclose a Mineral Resource in 2020.

d) Quoted as diluted in situ metric tonnes and grades. Metallurgical recovery factors have not been applied to the Mineral Resource estimates. The approximate metallurgical recovery factor is 96.5 %. The metallurgical recovery is the ratio, expressed as a percentage, of the mass of the specific mineral product actually recovered from ore treated at the plant to its total specific mineral content before treatment.

e) The underground Mineral Resources are typically confined using Mineable Shape Optimiser (MSO) software to generate realistic stope design geometries encompassing minimum mining width and cut-off grades.

f) The metal prices used for the 2021 Mineral Resources are based on a gold price of $1,500 per ounce or ZAR 750,000 per kilogram (at an exchange rate of ZAR 15.55 per $1.00). The gold price used for Mineral Resource estimates approximates 15 % higher than the selected Mineral Reserve gold price.

g) The cut-off grade may vary per area depending on the respective costs, mining method, depletion schedule, expected mining dilution and expected mining recovery. The following are the average or range of cut-off grade values applied to the Mineral Resources are: South Deep NoW and SoW areas 3.44 g/t to 6.00 g/t gold mill feed from underground.

h) The Mineral Resources are based on initial assessments at the Mineral Resource gold price of $1,500/oz and consider estimates of all South Deep costs, the impact of Modifying Factors such as cut-off grade, mining dilution and mining recovery, processing recovery, royalties and taxes. Mineral Resources are also tested through the application of Environmental, Social and Governance (ESG) criteria to demonstrate reasonable prospects for economic extraction.

i) The Mineral Resources are estimated at a point in time and can be affected by changes in the gold price, US Dollar currency exchange rates, permitting, legislation, costs and operating parameters.

Source: South Deep CPR 2021

The Mineral Resources are based on initial assessments at the Mineral Resource gold price of $1,500/oz and consider estimates of all South Deep costs, the impact of Modifying Factors such as mining dilution and recovery, processing recovery and royalties to demonstrate reasonable prospects for economic extraction.

14.3 Audits and reviews

Gold Fields' Mineral Resource estimates are reviewed on an ongoing basis by an internal team administered by its CTS group and cyclically by external and independent experts from industry recognised geology and mining consultancies.

Gold Fields follows an embedded process of third-party reviews to provide expert independent assurance regarding the Mineral Resource estimates and compliance to the appropriate Reporting Codes. In line with Gold Fields' policy, each operation or material project is reviewed by an independent third party on average of no less than once every three years, or when triggered by a material new Mineral Resource declaration. An expansive external and independent review of South Deep's Mineral Resources and Mineral Reserves was conducted in 2019 for the 31 December 2018 disclosure and this was reviewed and updated by the same consultants for this 31 December 2021 life of mine plan. To ensure follow-up on the 2019 SRK recommendations, SRK have found the South Deep Mineral Resource and Mineral Reserve to be in accordance with relevant Reporting Codes and regulatory guidance and reported to the appropriate technical standard with no stated material issues or non-compliances. No adverse findings were recorded from this audit and the following observations were made:

- The work audited was compliant with SAMREC Code (2016) and JSE Section 12.
- The work was completed to an appropriate technical standard.
- There were no material technical con-compliances identified.

Supporting findings and recommendations were made and these pertain to maintaining transparency on material issues. The mine has since addressed most of the issues with some to be addressed and closed off by the end of 2022.

The South Deep Mineral Resource estimate was also subjected to internal review by the relevant Qualified Persons and regional technical and financial disciplines, and peer reviewed for technical assurance and compliance in reporting by Gold Fields' CTS, Sustainable Development and Head Office Finance teams.

The Mineral Resource is underpinned by appropriate Mineral Resource Management processes and protocols to ensure requisite corporate governance in respect of the intent of RACM. Technical and operating procedures that have been developed on site are designed to be compliant with the risk assessment control matrix (RACM) as adopted by Gold Fields' Mineral Resource Management for Mineral Resource and Mineral Reserve estimation, reporting and auditing.

Gold Fields uses K2Fly RCubed® propriety software in combination with SharePoint to ensure accuracy, governance and auditability in the reporting of Mineral Resources and Mineral Reserves.

The Qualified Person is of the opinion that:

a) The historic exploration results have been incorporated into the South Deep database with the necessary due diligence and technical QAQC assurance required to validate the information.

b) Currently mined areas have been superseded and supplemented by more recent resource and mine definition drilling undertaken by Gold Fields and any historic deficiencies will have little influence on the current Mineral Resource models or the life of mine Mineral Reserves going forward.

c) Current QAQC processes are in place to ensure adequate scrutiny of data and models.

d) The Indicated and Measured Mineral Resource is sufficient in geoscientific confidence to complete final life of mine designs.

e) Mine design inputs are reviewed and signed off by the relevant role-players prior to issuing for design.

14.4 Comparison 31 December 2021 with 31 December 2020 Mineral Resource

No Exclusive Mineral Resources were disclosed in 2020. For Inclusive Mineral Resources please refer to the Gold Fields Supplement to the Integrated Annual Report. Reporting of Exclusive Mineral Resources in this document is chosen to align with Gold Fields SK-1300 reports. Exclusive Mineral Resources have not been disclosed on any stock exchange previously; however, in the Qualified Persons opinion the 2021 to 2020 resource comparison changes are not material.

15 Mineral Reserve estimates

15.1 Level of assessment

South Deep's Mineral Reserves are that portion of the Mineral Resources which, as technical and economic studies have demonstrated and with the support of annualised life of mine planning, scheduling and costing, can justify economically viable extraction as at 31 December 2021.

The Mineral Reserves are based on appropriately detailed and engineered life of mine plans and are supported by relevant studies completed to a minimum pre-feasibility study level. The life of mine plan is based on Measured and Indicated Mineral Resources converted through the application of appropriate Modifying Factors to derive Mineral Reserves estimates.

A pre-feasibility study has an estimated accuracy for operating and capital costs of ±25 % with a contingency of no more than 15 %.

All mine design and scheduling is completed by experienced engineers using appropriate mine planning software and incorporates relevant mining methods, Modifying Factors, cut-off grades and the results from other techno-economic investigations.

Mining rates, fleet productivities, operational and plant capacities and constraints are accounted for in the plan and are typically based on historical performance trends. All geotechnical protocols and constraints are accounted for in the plan, including the provision for suitable mining geometries, mining losses, mining recovery and dilution. Provision is also made for sufficient waste rock and tailings storage with plans to meet the life of mine requirements. The Company's mine closure plans comply with in-country legal requirements and are approved by the regulator. Integrated mine closure plans provide appropriate cost parameters for operational and life of mine planning as well as end of life mine closure commitments.

The point of reference for the Mineral Reserves is ore delivered to the processing facility.

The Qualified Person's opinion of the 2021 Mineral Reserve estimates is:

a) The Modifying Factors are predominantly based on recent mining and processing extraction history and performance and are reasonable and appropriate to derive the Mineral Reserves from the Mineral Resources and minimize any estimation errors. The derivation of the Modifying Factors is aligned with leading industry technical practice.

b) Infrastructure, environmental, permitting, closure, utilities and baseline studies are all aligned to support and sustain the life of mine plan. South Deep's proactive study, continuous improvement and modernization pipeline retains a focus on progressing all key work integral to supporting ongoing life of mine extensions so as to avoid any potential production delays.

c) The Indicated and Measured Mineral Resource is sufficient in geoscientific confidence to complete final life of mine designs. However, it is protocol to complete a final phase of grade control drilling to determine a high confidence 'mine defined' reserve with detailed geoscientific information prior to final stope design, pillar layouts and detailed production scheduling.

d) The reported Mineral Reserve is a 'point in time' or snapshot of the life of mine plan as at 31 December 2021. It is supported by a technically valid and economically viable mine design and annualized schedule. The techno-economic work does not exceed the estimated accuracy of ±25 % and or require more than 15 % contingency for both operating and capital costs.

e) Environmental compliance and permitting requirements have been assessed in detail with supporting baseline studies and relevant preliminary internal impact assessments completed where appropriate. Detailed tailings disposal, waste disposal, reclamation, and mine closure plans are incorporated into the life of mine plan.

f) The life of mine plan, in total, is completed to an overall pre-feasibility level of study, although certain components of the plan have been completed to a feasibility level of study.

15.2 Mineral Reserve estimation criteria

15.2.1 Recent mine performance

South Deep's recent performance is summarised in Table 15.1.

Table 15.1: South Deep – recent operating statistics

Category	Units	2021	2020	2019
Development				
Total development	m	10,282	7,161	7,485
- Waste development	m	3,192	1,569	1,444
- Reef development	m	7,090	5,591	6,041
Underground mining (including development)				
Total de-stress mined	m²	44,398	35,545	26,606
Total mined	kt	1,740	1,221	1,138
- Waste mined	kt	201	86	77
- Ore mined	kt	1,540	1,136	1,060
Mined grade (ore only)	g/t Au	6.3	6.3	6.2
Mined grade (ore and waste)	g/t Au	5.6	5.9	5.8
Gold broken	kg	9,744	7,161	6,545
Processing				
TSF mining	kt	1,233	1,048	515
TSF grade	g/t Au	0.11	0.2	0.3
Waste treated	kt	154	55	53
Underground ore treated	kt	1,536	1,154	1,098
Total tonnes treated	kt	2,922	2,258	1,666
Underground ore yield	g/ Au	5.8	6.0	6.2
Head grade (combined)1	g/t Au	3.3	3.3	4.4
Yield (combined)	g/t Au	3.1	3.1	4.2
Plant recovery factor (underground)	%	94.7	97.0	96.2
Plant recovery factor (surface)	%	43	47	56
Total gold production	kg	9,102	7,056	6,907
Gold sold	koz	293	227	222
Financials				
Au price received	$/oz	1,790	1,763	1,418
	R/kg	851,102	928,707	659,111
Exchange rate (annual average)	R:$	14,79	16.38	14.46
Cost of sales before amortisation and depreciation	R million	4,510	3,751	3,503
	R/kg	495,498	531,607	507,099
Capital expenditure (capex)	R million	1,320	804	479
	R/kg	145,023	113,933	69,365
	$/oz	305	216	149
All-in costs (AIC)	R/kg	655,826	663,635	585,482
	$/oz	1,379	1,260	1,259
All-in sustaining cost (AISC)	R/kg	622,726	651,514	585,482
	$/oz	1,310	558	1,259

Notes: The operating statistics are based on annual fiscal year measurements

Source: South Deep CPR, 2021

15.2.2 Key assumptions and parameters

The assumptions and parameters considered in the Mineral Reserve estimate are summarised in Table 15.2.

Table 15.2: South Deep - summary of material Modifying Factors

	Units	2021	2020	2019
Mineral Resource Modifying Factors				
Mineral Resource gold price	$/oz	1,500	1,500	1,400
Mineral Resource gold price	R/kg	750,000	750,000	625,000
Cut-off grade range	g/t	3.4 – 6.0	3.0 – 6.0	3.4 – 6.0
Exchange rate (Rands/US$)	R/$	15.55	15.55	13.88
Mineral Reserve Modifying Factors				
Mineral Reserve gold price	$/oz	1,300	1,300	1,200
Mineral Reserve gold price	R/kg	650,000	650,000	550,000
Exchange rate (Rands/US$)	R/$	15.55	15.55	14.25
Cut-off grade range (NoW – SoW)	g/t	4.0 – 4.4	3.8 – 4.2	4.1 – 4.5
Mine call factor	%	100	100	100
Mining dilution	%	11.5	13.5	13.5
Mining loss	%	13.0	13.0	14.0
Mining recovery	%	87	87	85
Process recovery	%	96.5	96.3	96.3
Processing capacity	Mt/a	4.0	4.0	4.0

Notes: The life of mine plan Modifying Factors are valid as at 31 December 2021.

The cut-off grades are the lowest grade of mineralized rock which determines whether it is economic to recover its gold content by further, calculated as per the Gold Fields cut-off grade guidance on methodology and protocol; see Item 14.1.7 for more information on cut-off grade calculation methodology.

Source: South Deep CPR, 2021

Modifying Factors built into in the life of mine plan reflect the following assumptions:

- Implementation of improved drilling equipment.
- Mechanised long-hole stope (LHS) explosive charge-up implementation.
- Introduction of an improved/simplified initiation system in LHS.
- Larger portion of mining from the NoW area, offering improved stoping conditions.

Total Cost assumptions comprise:

- Operating Cost Components: include direct mining costs, direct processing costs, direct G&A costs, consulting fees, management fees, insurance fees, and realisation charges.
- Capital Costs: includes all sustaining and growth capital requirements.
- Other Costs: include sundry expenditure, rehabilitation contributions, silicosis liability and the changes in working capital.
- Royalties, taxes and Government levies are recorded individually where applicable in line with legislation.
- BEE partner preference dividends are included as a separate line item.

Mining costs include all direct mining, engineering maintenance and backfill placement activities in the mining areas.

Processing costs include tailings and waste disposal costs, as well as the cost of maintaining plant infrastructure.

G&A costs include allocated centralised costs for health and safety, mine technical services, occupational environment and hygiene, environmental management, human resources, finance, and other typical centralised costs. Concurrent rehabilitation costs are also included. No salvage value is assumed for plant and equipment.

In addition to long-term capital projects, the life of mine capital expenditure programs generally include details based on approved expenditure programs.

Further details on the forecast operating and capital costs are provided in Item 21.

As disclosed in Item 14.1.7, Gold Fields conducts an annual review of metal prices for Mineral Resource and Mineral Reserve reporting to monitor any significant changes that would warrant re-calibrating the price deck for strategic, business or life of mine planning purposes. This review considers prevailing economic, commodity price and exchange rate trends, together with market consensus forecasts and Gold Fields' strategy and expectations for the mine operations.

The Mineral Reserve gold price of $1,300/oz is discussed in Item 19 Marketing.

The Qualified Person is of the opinion that the gold price applied to the estimation of the Mineral Reserves is reasonable and suitable for life of mine planning and is an appropriate reflection of recent historical trends and importantly provides a metal price that mitigates the risk of short to medium term price fluctuations with the potential to impact on the execution of the life of mine reserve plans. The gold price used provides a reasonable long-term delta to current spot prices and incorporates into the life of mine plan appropriate contingency to offset possible short term lower price cycles.

15.2.3 Mineral Reserve cut-off grades

Cut-off grades are influenced by the operating strategy, cost base and design and scheduling, and are therefore calculated annually in alignment with the Gold Fields cut-off grade guideline. The purpose of the guideline is to ensure consistency in the cut-off definitions and cut-off processes across all company properties. Cut-off grades are not only calculated globally for a mining operation, but also for separate major mining areas dependent on various factors such as ore type, mining method, haul distances, recoveries and the mining, processing and general and administration costs.

The cut-off grades used for the underground Mineral reserves are calculated using the same methodology described in Item 14.1.7 at the Mineral Reserve gold price of $1,300/oz. gold. The cut-off grades by area and deposit (Upper Elsburg and VCR) are summarised in Table 15.3.

Table 15.3: South Deep underground Mineral Reserve cut-off grades

Area	Mineral Reserve cut-off grade (g/t) Run-of-mine	Expected process recovery cut-off grade (%)	Minimum mining width (m)
Current Mine	4.02	95.6	5
North of Wrench	4.02	95.6	5
South of Wrench	4.44	95.6	5

Notes:
a) The cut-offs are estimated based on the Mineral Reserve price, Mineral Reserve Modifying Factors and are not expected to change materially over the life of mine Mineral Reserve based on current information and inputs
b) The cut-off grades, price and Modifying Factors are incorporated in the estimation of the Mineral Reserves
c) The Qualified Person is of the opinion that the technical diligence and assurance underpinning the mine design and scheduling of the Mineral Reserve is appropriate to minimize estimation errors and derive a realistic and executable life of mine plan.

Source: Gold Fields COG Report, 2021

15.2.4 Mine planning and schedule

Overview

The Company's annual mine planning process is anchored by a corporate planning calendar that sets out the sequence of events to be followed that ensures a strong linkage between the strategic planning phase and the life of mine plan itself that defines the Mineral Reserves. During the first half of the year the preferred strategic plan is confirmed and approved by the Company's Executive Committee. This provides guidance for required investment and business and operational planning to position the mine to deliver on the strategic intent for the property. The detailed two-year operational plan and budget is informed by financial parameters determined by the Executive Committee and is the anchor to the longer-term planning and equates to the first two years of the life of mine plan.

The overall planning process schedules key work to be completed and stage gated before subsequent work can be continued and includes the metal prices, geology and estimation models, resource models, mine design, depletion schedules, environmental and social aspects, capital and operating costs and finally the cash flow model and financial valuation. Capital planning is formalised pursuant to Gold Fields' capital investment and approvals process.

Projects are categorised and reviewed in terms of total expenditure, return on investment, net present value (NPV) and impact on All-in Costs (AIC) per ounce and all projects involving amounts exceeding $40 million are submitted to the Board for approval. Material changes to the plans are referred back to the Executive Committee and the Board. Post-investment reviews are conducted to assess the effectiveness of the capital approvals process and to leverage continuous improvement opportunities going forward.

The Mineral Reserve estimates are based on an appropriately detailed and engineered life of mine plan that is supported by relevant studies completed to a minimum pre-feasibility level of work. All design and scheduling is completed by experienced engineers using appropriate mine planning software and incorporates all relevant Modifying Factors, the use of cut-off grades and the results from other techno-economic investigations. Mining rates, fleet productivities and all key operational and plant capacities and constraints are accounted for in the plan and are typically based on historical performance trends. All geotechnical protocols and constraints are accounted for in the plan, including the provision for suitable mining geometries and ground support, mining losses in pillars, mining recovery and dilution. The provision of sufficient waste storage and tailings capacity is engineered into the plans to meet the life of mine requirements.

Mine planning is driven primarily by personnel at the mine who are best positioned to determine the technical and commercial objectives for the site based on the parameters, objectives and guidelines issued by the corporate office. The site-based planning is supported by regional technical services functions, as well as from CTS and the corporate finance and sustainable development teams which provide overall oversight and assurance.

South Deep is an ultradeep bulk mechanised mine exploiting the wedge shaped and shallow dipping Upper Elsburg Orebody, rendering it unique in its pioneering mining method. The mining method has evolved through various stages based on experience and a continuous improvement strategy drives ongoing incremental enhancements to the mine design and extraction sequencing.

Due to its depth, seismicity remains a constraint and a key consideration in mine design and execution. The medium and longer-term control programs are designed to manage this risk and recent enhancements, including face support, pre-conditioning, improved pillar design, layout protocols and extraction sequencing, are all proving to be effective and will benefit from ongoing improvements were warranted. Specialist third-party reviews by the South Deep's Geotechnical Review Board (GRB) found the mine's seismic management practices to be appropriate and ongoing monitoring and assessment suitable to drive business improvement.

South Deep's production ramp-up plan to steady state operational levels is based on increased stoping output from mechanised de-stressed areas, together with improvements required in equipment productivities. In 2020 to 2021, the mine has demonstrated that the required productivity rates are achievable and good progress was made to develop the infrastructure for the new de-stress cuts to establish the next phase of mining in the designated corridors.

Mining dilution and mining loss factors applied to the Mineral Reserves are calibrated in line with actual performance trends and the Modifying Factors are deemed to be overall conservative with incremental improvements in metal loss and mining recovery anticipated in the future. Detailed operational modelling that profiles realistic mining sequences and equipment productivities is incorporated into the development, de-stress and stoping activities to produce a fully integrated production schedule encompassing all key activities and their interdependencies.

The scheduling and commissioning of underground capital infrastructure is aligned to enable increased output, which includes crushers and conveyors being operational in late 2022 to early 2023, with the mining corridors achieving their planned design geometry in 2023. As a result, significant logistical improvements are anticipated due to independent ventilation districts, in-cut ore flow and improved fleet maintenance facilities. The re-based strategy, restructuring and revised operating model initiated in 2018 and embedded in 2019 to 2021 is incorporated in this life of mine plan, this will continue to be updated and recalibrated in time as more empirical operational data is gathered.

Mine design parameters

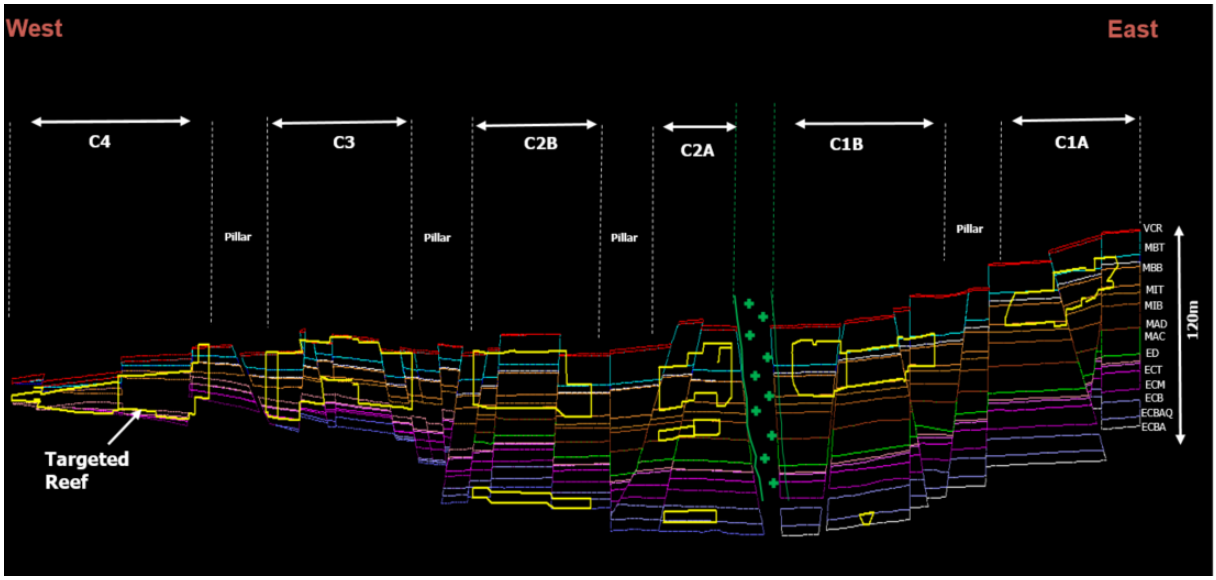
Primary input parameters and assumptions to the mine design and scheduling are based on first principles and are calibrated in accordance with empirical operational data to ensure practicability and reasonableness.

Mining targets are derived from the 3D resource block model which includes grade and geological information. The block model is used to derive feasible mining envelopes defined in consideration of:

- Cut-off grades
- Geotechnical parameters
- Applicable mining method parameters
- Proximity to infrastructure and access.

From this process, 3D mining shapes are defined which are subjected to detailed mine design including access development, infrastructure requirements, de-stress and stoping (yellow blocks in Figure 15.1 define the stoping geometry overlain on the orebody's stacked reefs). The detailed design is then extraction sequenced and scheduled, considering all resource allocations, crew efficiencies and possibly other identified workplace specific constraints.

Figure 15.1: Cross section of mining shapes superimposed on the orebody



Source: South Deep CPR, 2021

Modifying Factors applied to the detailed designs account for mining dilution and mining losses. The resultant annualised mine schedule forms the basis of the tonnes, grade and gold mined and delivered to the process plant that equates to the Mineral Reserve estimate.

The key fundamentals of the mine design rationale are:

- CM utilises scattered mechanised development with LHS, drifting and benching mining methods.
- NoW and SoW areas utilise mechanised de-stress and LHS.
- Infrastructure is configured on a per mining cut basis i.e., engineering, ore and vent passes and dual main access drives (MAD).
- Converting footwall infrastructure from track-bound to trackless mechanised equipment.
- Removing trucks from the stoping horizons.
- Mine only primary stopes where stopes hole into tabular conventional excavations.
- Mining under backfill trials started in 2021, results are favourable and further trials will continue in 2022.
- Stope sequencing typically starts at the access to the mining cut from the footwall development and progresses to the limit of the cut but can be adjusted depending on site specific conditions.

Design criteria for the mine excavations are:

- Clearances in-section roadways or in any place where trackless mobile equipment (TME) operate should be 0.90 m on either side of the sidewall. At tipping points and other excavations, the clearance should be at least 0.62 m either side of the sidewall.
- Sufficient gradient for horizontal development in the de-stress access and cuts to ensure drainage of water and no ponding (minimum of 1 °).
- Excavations not to be closer than 8.00 m to long term excavations such as ramps.
- Excavations not deemed long-term, such as drifts must have a minimum middling of 5.00 m.
- LHS access below conventional stopes must have a minimum middling of 5.00 m to conventional stopes.
- All incline and decline development will not exceed a maximum gradient of 8 °.
- Changes from a flat gradient to an incline gradient shall take place gradually over 10.00 m.
- The turning radius on a ramp is 15 ° (centreline). When a breakaway ramp is designed, 5.00 m must be designed at a flat gradient before the gradient is changed for the ramp (max 8 °).

The recommended excavation dimensions designed to meet rock engineering, safety and ventilation requirements are summarised in Table 15.4.

Table 15.4: South Deep excavation dimensions

Description	Width (m)	Height (m)
Current Mine development	5.0 – 6.0	5.5
Cut access development	5.0 – 8.2	5.5 – 8.5
Footwall crosscuts	5.0 – 6.5	5.5 – 6.0
De-stress development	6.0	5.5

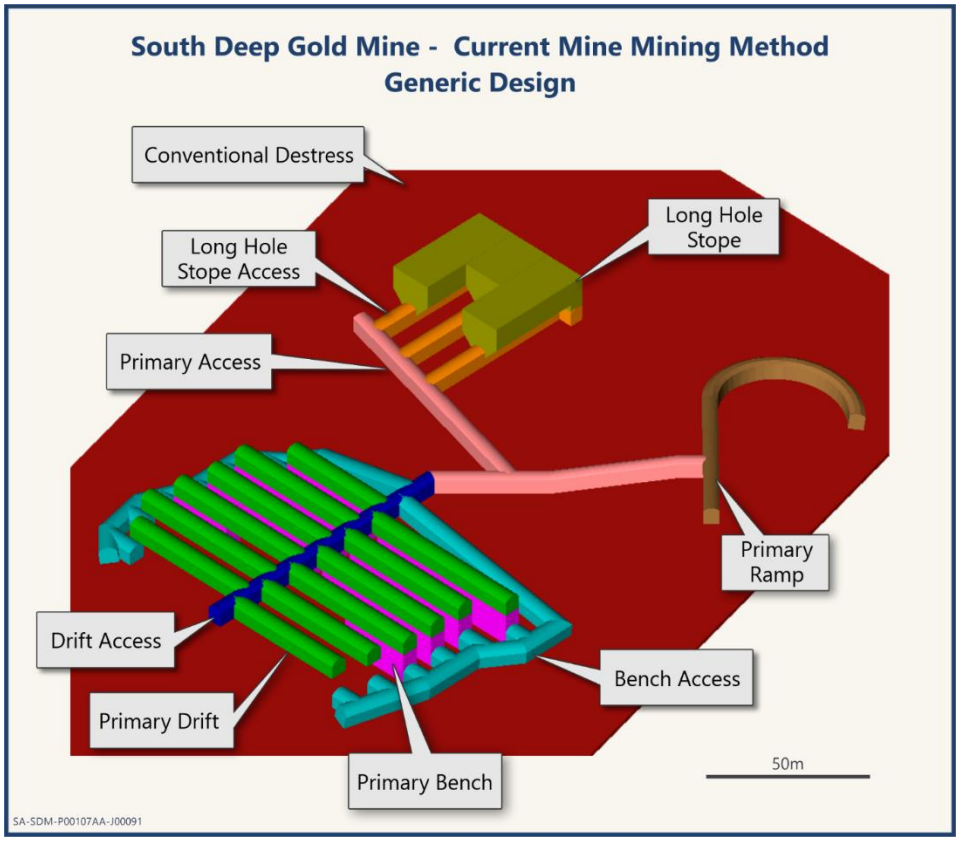
Source: South Deep CPR, 2021

Other mine design criteria used include:

- De-stress yield pillars are designed with maximum dimensions that cannot be exceeded to mitigate the risk of rock bursts and to ensure ground stability and are typically 7 m wide and 14 m to 30 m long, depending on the length of the stope access drives (SAD).
- Vertical middling (hangingwall of lower cut to footwall of upper cut) in the de-stress will be maintained at a minimum of 14.5 m.
- South Deep underground workings are divided into four mining areas (Figure 5.2):
- CM: between 85 and 95 Level (predominantly de-stressed by historical conventional mining).
- NoW: south of the CM and north of the Wrench Fault (contains the transitional phase to current mechanised de-stress).
- SoW West: accessed from 105 and 110 Levels and south of the Wrench Fault.
- SoW East: accessed from 95 and 93 Levels and south of the Wrench Fault.

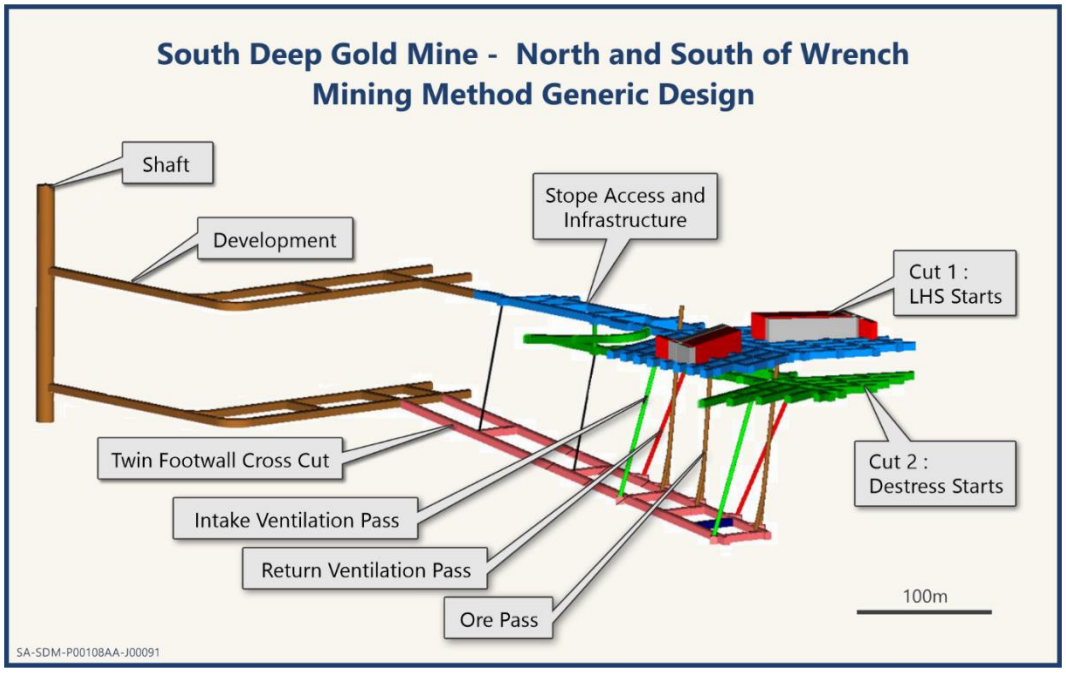
The CM mining method generic design is shown in Figure 15.2. the mining targets, de-stressed by the conventional mining prior to 2008 are extracted with drifts (6 m (w) x 5.5 m (h)), benches above or below the drifts and LHS (where the target thickness allows). In the NoW area where targets have not been de-stressed a de-stressing cut (consisting of development excavations mined parallel to one another with 7.0 m spacings) is mined to reduce the surrounding stress and enable the mining of long-hole stopes. The de-stress excavations also serve as access to the long-hole stopes. The horizontal de-stress and LHS concept design for the NoW and SoW areas is shown in Figure 15.3.

Figure 15.2: Current Mine mining method generic design



Source: South Deep CPR, 2021

Figure 15.3: North of Wrench and South of Wrench mining method generic design



Source: South Deep CPR, 2021

Equipment

South Deep utilizes trackless mobile machines extensively for its mining processes. The underground trackless fleet is summarised in Table 15.5.

Table 15.5: South Deep mobile fleet

	Activity	Model	Units
Cat-A	Support / bolting	Bolter, Sandvik, DS411	1
	Support / bolting	Cable bolter, Sandvik, DS421	1
	Support / bolting	Boltec, Epiroc, M6C	2
	Hauling	Dump truck, Atlas Copco, MT2010	5
	Hauling	Dump truck, Atlas Copco, MT4368	8
	Hauling	Dump truck, Sandvik, TH430	5
	Support / bolting, scaling & face drilling	HP drill rig, Atlas Copco, 282	2
	Support / bolting, scaling & face drilling	HP drill rig, Sandvik, DD321	14
	Mucking	HP LHD, Atlas Copco, ST1030	4
	Mucking	LP LHD, Sandvik, LH208	3
	Mucking	HP LHD, Sandvik, LH410	1
	Mucking	HP LHD, Sandvik, LH514	25
	Long-hole drilling	LHS rig, Atlas Copco, 1257	1
	Long-hole drilling	LHS rig, Atlas Copco, M6C	3
	Long-hole drilling	LHS rig, Altas Copco, S7D	4
Cat-B	Long-hole charging	Charmec, Aard, charge master MK1	1
	Long-hole charging	Charmec, Aard, charge master MK2	2
	Long-hole charging	Charmec, Aard, K2	3
	Face charging	Charmec, Aard, UV80	8
	Transport	LDV, Toyota, Land Cruiser	19
	Utility	Maintenance vehicle, Aard, UV80	9
	Utility	Scissor Lift, Aard, 6M, UV80	12
	Utility	Scissor Lift, Aard, dedicated fixed 3.5	25
	Scaling	JDS scaler	2
	Mobile rock breaker utility vehicle	Drill rig, Sandvik, DB120	1

Source: South Deep CPR, 2021

The mining fleet is planned with the drill rig as the primary productive unit (development, de-stress and stoping) and units are allocated in accordance with geographic working areas, face availability, efficiency and excavation sequencing requirements. The load and haul fleet requirement is determined in accordance with efficiency expectations and the level of resource utilisation.

The focus for the face drill rigs is on maximising availability and reliability to enable them to perform to plan and to not compromise the overall mining cycle efficiency. The load and haul and backfill cycle times are also important to optimise to enable planned stope turnaround times to be achieved.

Non-standard units still in deployment will be phased out over time as the units reach the end of their useful life.

To achieve increased reliability of machinery, specialised teams per mining corridor have been created. Each corridor comprises of:

- Trackless mobile Engineer to facilitate and manage all the engineering teams in the respective corridor.
- Maintenance planner to facilitate planning, schedule routine services and manage parts provision in collaboration with the warehouse.
- Drill rig team to provide support to the development, de-stress and long-hole stopping machinery.
- Load and haul team to provide support to the LHDs and dump trucks.
- Utility team to provide support to all utility vehicles in the corridor.
- Outsourced support teams to provide support to development, long-hole stope and bolter teams and to provide other teams with services and support on tyres, hoses and line boring.

Ventilation

The life of mine plan is based on the production schedule for the CM, NoW and SoW areas as well as the "New Mine Development" section, which consists primarily of waste development mining on 100, 105 and 110 Levels. The ventilation and refrigeration requirements are derived from the heat load calculated by means of first principles. The results from the planning calculations are compared and verified with models built in VUMA 3D®, a program used for the simulation of underground environments. Within the life of mine plan, three years (2020, 2030 and 2050) were identified for building "snapshot" models to verify planning inputs and ventilation refrigeration, and cooling requirements.

Current installed refrigeration capacity can meet the cooling requirements up to 2025 after which additional refrigeration will be installed to meet production demands. The additional cooling includes a new refrigeration plant on 80 Level South Shaft consisting of six 5.0 MW refrigeration units (one unit on standby) installed in phases. All underground cooling installations are located in the intake of each corridor.

The overall underground ventilation requirement is based on the heat loads generated by mining activities (37 %), trackless machinery and other equipment (31 %) as well as heat generated as result of auto compression (26 %), the remainder of the heat generated by auxiliary activities. Primary ventilation will be provided by means of main surface fans installed on both shaft complexes, capable of circulating 1,700 kg/s at peak ventilation requirement. The maximum ventilation required by 2025 will be 1,500 kg/s.

Secondary ventilation requirements are typically based on the ventilation design criteria to ensure that the working areas are conducive and ventilated effectively to minimise risk in terms of diesel particulate matter, crystalline silica dust and flammable gasses and fumes. Due to the vast difference in the mining methods and the position of the current mining areas in relation to the life of mine strategy, secondary ventilation requirements are very site specific, especially during the transition phase as airways will not be in place to ventilate according to the future strategy.

Mine schedule

The mine schedule is based on the following key fundamentals and rationale:

- Production build-up based on an increased contribution from LHS in NoW and maturing corridors.
- SoW West and East areas build-up to maintain steady state commensurately with CM and NoW depletion.
- Restrict production in transitional areas to mitigate challenging mining conditions.
- Equipment productivity improvements from 2023 onwards as the contribution from the new corridor cuts (with dedicated infrastructure) increases.
- 87 Level 1W and 2W deferred to end of CM to buffer transition to SoW.
- 100 Level 1AW start up deferred to 2023 to reduce current working capital.
- Primary and secondary stoping philosophy applied where already in place and sequential stoping for new cuts going forward.
- Stoping scheduled to mine below open voids with mining below backfill starting in 2021.

Mining rates and productivity assumptions include improvements from 2023 to 2027 based on an increasing contribution from the new cuts in the NoW corridors where dedicated infrastructure is designed to streamline activities, with dump trucks moved out of the reef horizon and the crusher and conveyer system commissioned.

The productivity assumptions are summarised in Table 15.6.

Table 15.6: South Deep productivity assumptions

Input	Unit	2021 Actual	2021 BP	Life of mine plan
Development	m/month /rig	91	79	93
De-stress	m/month /rig	74	72	94
Stope drilling	t/month/rig	14,570	15,711	16,173
Fill delay	Days	75 – 180	75 - 180	75 - 180
Stope sequencing - vertical	-	Mine below void	Mine below void	Top/down
Stope sequencing - horizontal	-	Sequential - back to front primary secondary retreat	Sequential - back to front primary secondary	Sequential - back to front

Source: South Deep CPR, 2021

The production work calendar is based on 365 days per year reduced by 12 public holidays and 7 union-agreed days off leaving production with 346 (+1 day on a leap year). Production schedules are based on a 4 x 4 shift cycle (day shift and night shift). The duration of each shift is 11.5 hours.

Development and de-stress activities are scheduled on three production streams and a maintenance stream, while stoping together with load and haul is scheduled on four production streams.

LHS is cycled in the production model based on instantaneous drilling and loading rates of the long-hole stope drill rigs and LHDs respectively. These rates are then applied to slotting and ring blasting when stopes become available in accordance with sequencing criteria. A variable efficiency output is delivered from the model largely dependent on stope availability, cycle and resource interaction, and the slotting versus ring blasting ratio.

A sequential stoping sequence is incorporated into the life of mine plan, which entails mining a stope adjacent to a previously mined stope after being backfilled. The delay built into the plan allows for a stope to be mined adjacent to a previously mined stope including the loading of ore from the last round of rings, building of barricades, filling the stope and allowing curing time for the backfill to reach sufficient strength to be mined next to or below. Backfill conditions vary relating to specific conditions and is grouped in accordance with the mining area. Specific stope delays are assumed in the plan for these stopes.

Refer to Item 22.1 for further details on the life of mine schedule outputs.

15.2.5 Geotechnical consideration

This is discussed in Item 16.3.

15.2.6 Geohydrological parameters

This is discussed in Item 16.4.

15.2.7 Processing schedule

The processing schedule is derived from the mining schedule. The individual ore type recovery formulas as detailed in Item 13 are used in the mine schedule to aggregate into an overall processing recovery.

Refer to Item 22.1 for details on the life of mine processing schedule.

15.2.8 Classification criteria

South Deep's Mineral Reserves are classified as either Proven or Probable in accordance with the definitions in NI 43-101.

Mineral Reserves include only Measured and Indicated Mineral Resources modified to produce Mineral Reserves contained in the life of mine plan.

A Proven Mineral Reserve is assigned if it is flagged as a Measured Mineral Resource, the Mineral Reserve block is covered by sufficient infill drillholes and/or exposed development face mapping. A Probable Mineral Reserve is assigned if it is a) flagged as an Indicated Mineral Resource, b) is only covered by exploration or widely spaced resource definition drillholes, and c) has no development face mapping.

15.2.9 Economic assessment

The basis for establishing economic viability is discussed in Item 22.

15.3 Mineral Reserves as of 31 December 2021

The South Deep Mineral Reserves as of 31 December 2021 are summarised in Table 15.7. The Mineral Reserves are 90.495 % attributable to Gold Fields and are net of production depletion up to 31 December 2021. The point of reference for the Mineral Reserves is ore delivered to the processing facility.

Table 15.7: South Deep - summary of attributable gold Mineral Reserves at the end of the fiscal year ended 31 December 2021 based on a gold price of $1,300/oz

	Tonnes/ (kt)	Grades/ (g/t Au)	Gold/ (koz Au)	Cut-off grades (g/t Au)	Metallurgical recovery (%)
Underground (UG) Mineral Reserves					
UG Proven Mineral Reserves	14,057	5.4	2,443	4.0 to 4.4	96.5
UG Probable Mineral Reserves	168,325	4.9	26,686	4.0 to 4.4	96.5
Total South Deep Mineral Reserves 2021	**182,381**	**5.0**	**29,129**	**4.0 to 4.4**	**96.5**
Total South Deep Mineral Reserves 2020	186,221	5.3	31,538		
Year-on-year difference (%)	-2 %	-6 %	-8 %		

Notes:
a) Rounding of figures may result in minor computational discrepancies.
b) Refer to Table 15.8 for year-on-year Mineral Reserve comparison.
c) Quoted as mill delivered metric tonnes and run-of-mine grades, inclusive of all mining dilutions and gold losses except metallurgical recovery. Metallurgical recovery factors have not been applied to the Mineral Reserve figures. The approximate metallurgical recovery factor is 96.5 %. The metallurgical recovery is the ratio, expressed as a percentage, of the mass of the specific mineral product actually recovered from ore treated at the plant to its total specific mineral content before treatment.
d) The gold metal prices used for the 2021 life of mine Mineral Reserves are S$1,300 per ounce or ZAR 650,000 per kilogram (at an exchange rate of ZAR 15.55 per $1.00).
e) Dilution relates to planned and unplanned waste and/or low-grade material being mined and delivered to the mill. The mine dilution factors is 11.5 % over life of mine but ranges from 10.2 % to 24.6 % (underground).
f) The mining recovery factor relates to the proportion or percentage of ore mined from the defined orebody at the gold price used for the declaration of Mineral Reserves. This percentage will vary from mining area to mining area and reflects planned and scheduled Mineral Reserves against actual tonnes, grade and metal mined, with all Modifying Factors, mining constraints and pillar discounts applied. The mining recovery factors range from 73.8 % to 92.6 % (underground) and is 86.8 % over life of mine.
g) The cut-off grade may vary per area depending on the respective costs, mining method, depletion schedule, expected mining dilution and expected mining recovery. The following are the average or range of cut-off grade values applied to the Mineral Reserves are: South Deep NoW and SoW areas 4.02 g/t to 4.42 g/t gold mill feed from underground.
h) A gold based mine call factor (gold called for over gold accounted for) determined primarily on historic performance but also on realistic planned improvements where appropriate, is applied to the Mineral Reserves. A mine call factor of 100 % has been applied at South Deep.
i) South Deep is 90.495 % attributable to Gold Fields and is entitled to mine all declared material located within the property's mining right and all necessary statutory mining authorizations and permits are in place or have reasonable expectation of being granted.

Source: South Deep CPR 2021

The South Deep Mineral Reserves are the economically mineable part of the Measured and Indicated Mineral Resources based on technical and economic studies completed to a minimum of a pre-feasibility level based on the Mineral Reserve gold price of $1,300/oz to justify their extraction as at 31 December 2021. The South Deep life of mine Mineral Reserve has a pre-feasibility study estimated accuracy of ± 25 % with a contingency lower than or equal to 15 %. Refer to Item 22 for details on the supporting economic analysis.

The mining shapes comply with cut-off grade, infrastructure and geotechnical criteria. South Deep does not use Modifying Factors to derive Mineral Reserves from Mineral Resources, the Mineral Reserve is fully designed from the Mineral Resource. Modifying Factors are used to account for mining losses and dilution applicable to the mine design and processing.

The Mineral Reserves are reported at a head grade inclusive of ore and in-section ore and waste development tonnes which cannot be separated in the ore flow. Capital waste is excluded.

The Qualified Person is of the opinion that the mine plan and schedule incorporate appropriate assessment of all relevant technical, environmental, social and financial aspects to ensure the Mineral Reserve complies with the NI 43-101. After reasonable assessment there is no unresolved material matter that could have a significant impact on the mines ability to execute the life of mine plan. The mine plan and schedule incorporate consideration of the following key criteria:

a) Production depletion up to 31 December 2021.

b) Application of cut-off grades to determine mineable ore.

c) Application of appropriate Modifying Factors to convert Mineral Resource to Mineral Reserve.

d) Allocation of suitable mining equipment and costs.

e) Incorporation of realistic mining rates and efficiencies.

f) Practical and realistic mine design and mining methods.

g) Integrated production scheduling taking account of cycle times, capacities, constraints and bottlenecks.

h) Use of appropriate back filling rates for stope voids.

i) Security of water and energy for the life of mine.

j) Provision for mine rehabilitation and mine closure costs.

k) Consideration of all environmental, social and legal aspects to enable life of mine plan execution.

l) Appropriate life of mine tail end management.

m) Security of current and future land tenure and relevant leasing agreements, permits and licences.

n) Life of mine cash flow model and economic viability.

15.4 Audits and reviews

Audits and reviews completed on the Mineral Reserve at South Deep during 2021 included:

- Site based internal peer reviews, validation and reconciliation of geology models, wireframes, estimates process and outputs with senior geology staff and department heads.
- Ongoing routine drilling, sampling and geology audits and reviews supplemented by coaching of all staff by senior geologists and department heads to ensure due process and RACMcompliance.
- Perth CTS audits and review of geology, Mineral Resource estimation, geotechnical and mine planning models.
- Gold Fields' Group Geology and Planning technical team reviews and site visits for validation and compliance evaluation of Mineral Resources and Mineral Reserves process, detail and output.
- ISO 14001 surveillance audit by recognised external auditors.
- ISO 45001 surveillance audit by recognised external auditors.
- ISO 27001 certification.
- TSF annual audit.
- TSF Global Reporting Initiative third party (KPMG).
- Ongoing routine internal audits (Gold Fields' Johannesburg Internal Audit).
- Annual external financial audits (KPMG to 2018, PWC from 2019).
- Internal legal compliance and ethics policy review.
- Annual external non-financial data compliance audits (ERM).
- Internal RACM compliance (Perth and Corporate auditors, including 2020 audits).
- External audit by SRK Australia December 2021 to March 2022.

No adverse findings were recorded from any of the audits. Ongoing compliance with minor improvement, adjustments and best practice continue to be implemented. Records of audits are filed electronically on site in relevant departments and folders with major audit signoffs reported in the Gold Fields annual report.

15.5 Comparison 31 December 2021 with 31 December 2020 Mineral Reserve

The net difference in Mineral Reserves between 3 December 2020 and 31 December 2021 is -2,409 koz or -8 % (Table 15.8).

- Cost increases were largely driven by inflation, which led to a higher cut-off grade, resulting in a 3 % reduction on life of mine Mineral Reserves.
- The life of mine Mineral Reserve converted 4 % less, due to enhanced Mineral Resources models year-on-year.
- Other reductions are due to the 2021 depletion (1 %).

Table 15.8: Net difference in Mineral Reserves between 31 December 2020 and 31 December 2021

Proved and Probable Mineral Reserve	Unit	Change (%)	Gold on run-of-mine (koz)
As at 31 December 2020	koz		31,538
Mining depletion	koz	-1 %	-273
Gold price	koz		0
Costs	koz	-3 %	-936
Exploration	koz		0
Conversion	koz	-4 %	-1,185
Inclusion / exclusion	koz		0
As at 31 December 2021	koz	-8 %	29,129

Source: South Deep CPR 2021

16 Mining methods

16.1 Background

South Deep was initially focused on extraction of the VCR orebody and targeted horizons on the Upper Elsburg reef from South Shaft. The narrow tabular orebody was mined in a conventional manner utilising hand held drilling, scraper winch cleaning and rail bound locomotive transport in a footwall infrastructure network. Conventional mining of the Upper Elsburg reefs continued up to 2008, when all conventional mining was halted and South Deep adopted a fully mechanised bulk mining strategy.

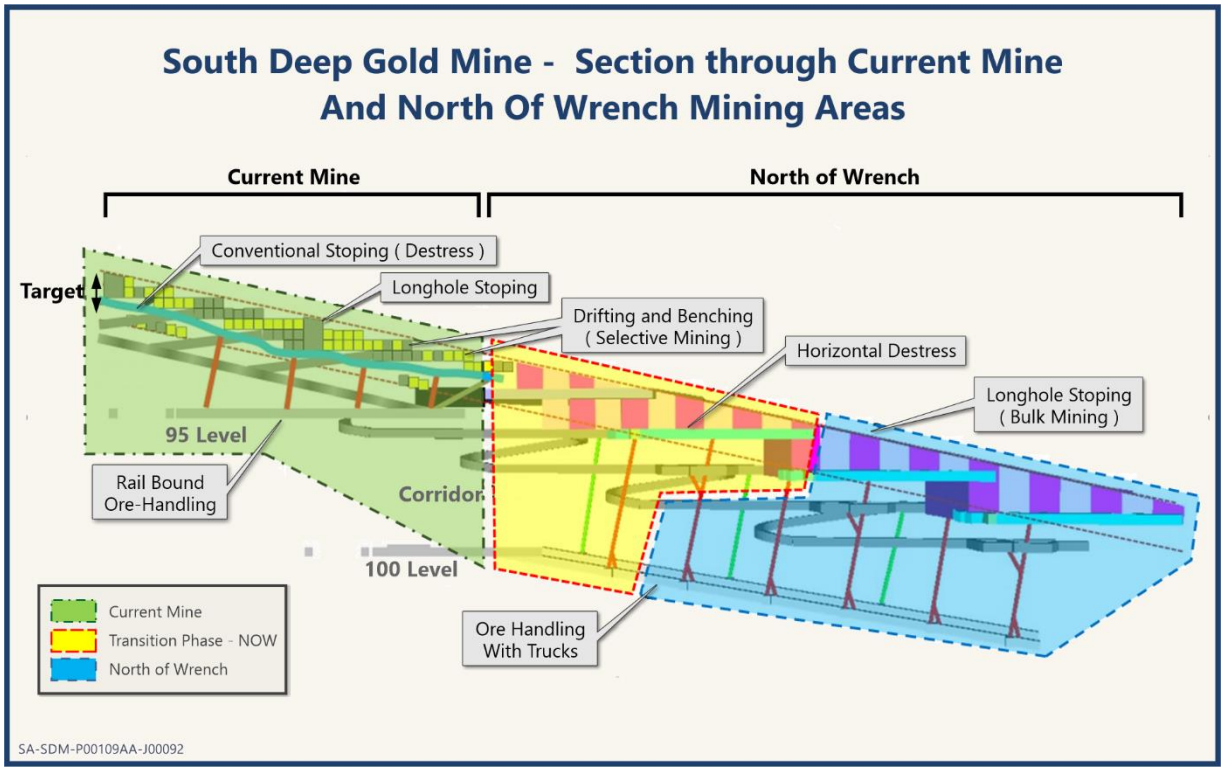
The mine commenced conversion of the CM area to a mechanised operation in 1998, extracting the remaining Upper Elsburg reefs above and below the conventionally mined reefs. The mining methods employed were primarily drifting and benching, initially on apparent dip and later converted to a horizontal method in 2002. The conventionally mined stopes created the de-stressed environment for the bulk mining activities. The de-stressed environment is essential to mitigate the risk of significantly elevated rock stress regimes at depth (circa 2,700 m to 3,300 m below surface) that would otherwise render the ability to mine massive bulk stopes impractical. The infrastructure required to support mechanised mining had to be converted to a hybrid of rail-bound and trackless. The new mine development on 100, 105, 110 and 110A Levels are designed to support bulk mechanised mining.

The portion of the orebody which was de-stressed with conventional mining was not sufficient to support the required production output, and therefore mechanised de-stress methods were implemented in 2008 to increase the bulk mining potential from the Upper Elsburg reefs. Initially a mechanised low profile (2 m high) apparent dip drifting and filling de-stress method was used. This was subsequently converted to a horizontal method in 2009 due to the difficulty in negotiating geological faults. The de-stress method combined the functions of de-stressing the orebody and providing access to long-hole stopes is depicted in Figure 16.1 highlighting the difference between the initial conventional mining method applied in CM with that now adopted in the NoW area.

Due to very high excavation closure rates experienced using the low profile de-stress method, the de-stress was converted to a high profile de-stress method with an increased crush pillar size in 2015, together with a reduction in mining span for the mining areas. Initially the mine consisted of three corridors converting into four. This has since been changed to six, thereby reducing mining spans from 240 m to 180 m (Figure 5.2). This conversion was necessary to increase the pillar support stiffness, which reduced excavation closure and energy release rates.

The high profile de-stress method implemented in 2015 as the primary de-stressing mining method is now an established practice on the mine. Six corridors are mined at 180 m horizontal strike spans between 60 m wide regional pillars.

Figure 16.1: Section through Current Mine and North of Wrench mining areas



Source: South Deep CPR, 2021

Modifications to the in-cut crush pillar dimensions occurred in 2017. Pillar sizes were increased from 6 m x 10 m to 8 m x 20 m to control local convergence and pillar deterioration. In 2020 the pillar dimensions were revised and reduced to 7 m x 15 m following the back analyses of three pillar burst events which occurred with slightly oversized pillars within the 8 m wide pillar layout. The 7 m wide pillars will ensure that pillar crushing occurs on the face when the pillars are formed. In addition, the mining orientation has changed from east-west (strike orientation) to north-south (dip orientation) to prevent ride occurring along problematic parting planes when intersected within the cut. Both these strategies should mitigate the instances of pillar burst and sidewall ejection related events.

16.2 Current mining methods

The CM area presently serves as a de-stress horizon for the application of mechanised mining methods in the form of drifts, benches and LHS to extract the remaining massive reefs above and below these tabular horizons. The infrastructure previously developed for conventional mining supports the mechanised mining being applied in the area.

The NoW area is largely unmined and employs a different method specifically designed for efficient massive extraction of the orebody. Mechanised horizontal de-stress similar to room and pillar mining constitutes the de-stress cut, after which the cut forms the platform for LHS to extract the massive targets above the cut. These cuts are stacked on top of each other at vertical distances of 20 m. The area consists of six independent corridors within which the method is applied. The NoW volume contribution increases year-on-year as the remaining Mineral Reserves in CM is depleted.

The SoW mining method will be similar to the NoW (horizontal de-stress and LHS). Access to the SoW West and East blocks will require significant capital infrastructure development.

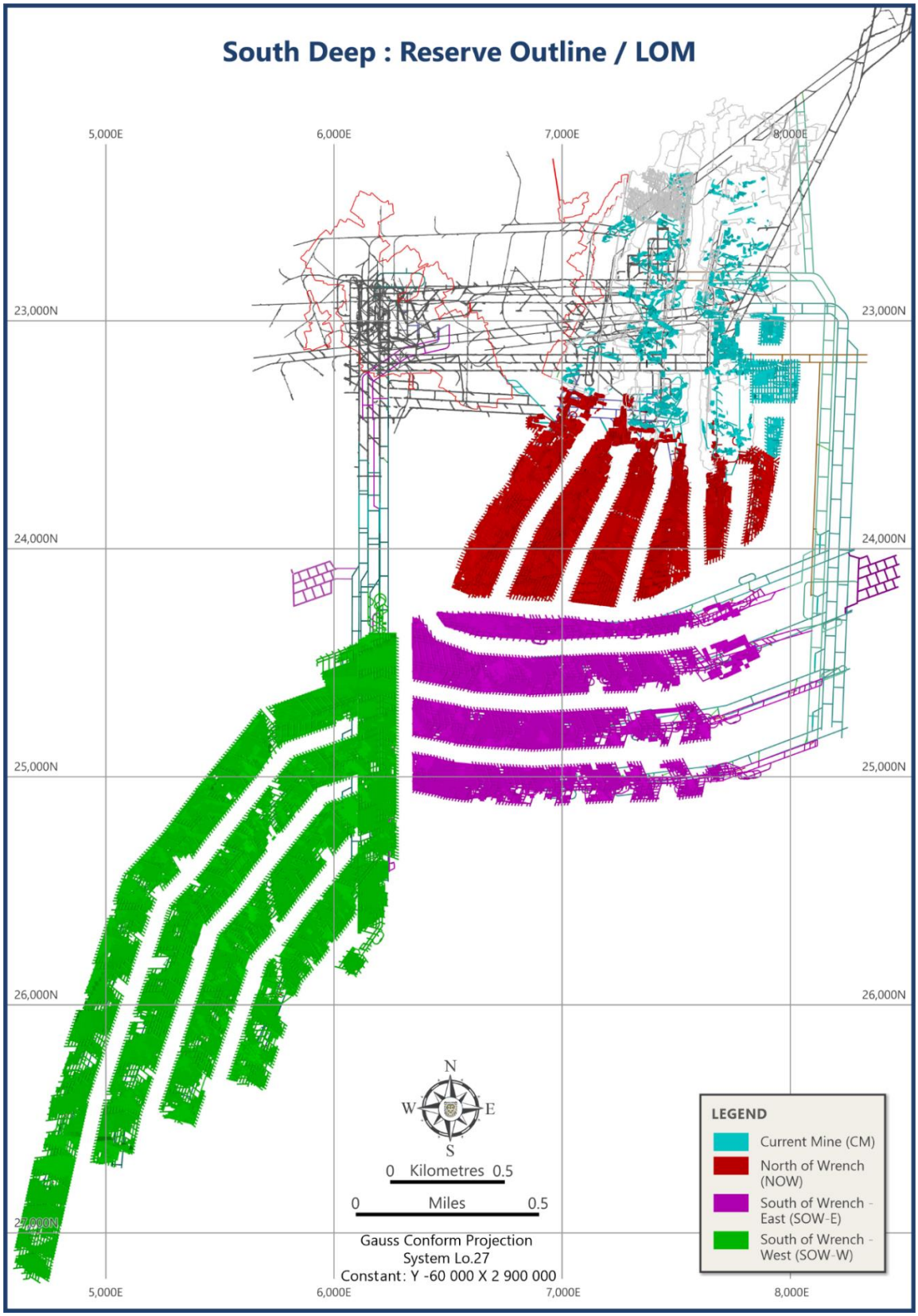
Initially a 5.5 m high horizontal slice is mined through the targeted reef package. This phase is referred to as de-stressing and the purpose of this phase is to de-stress the reef above and below this cut. The de-stressing of the reef allows for the mining of long-hole stopes without the high rock stresses associated with mining at depths of 2,700 m to 3,300 m. These horizontal de-stress cuts are mined at 20 m vertical intervals and constitute 11 % of the total reserve design. Mechanised de-stressing is only applicable to NoW and SoW.

LHS is accessed from the de-stress excavations and are limited in size to 20 m high and 60 m long. Where the reef targets are thicker than 20 m, long-hole stopes are stacked with up to three long-hole stopes making an overall target height of up to 60 m. Long-hole stopes makes up 56 % of the total Mineral Reserve design.

Where reef targets are thinner (between 5 m and 15 m) a more selective mining method is required. Drifting and benching are applied to these areas. Drifts are mined at a width and height of 6 m and 5.5 m respectively. The length varying depending on the target zone. Benches are mined from the drift's hang or foot up to heights (including the drift) of 15 m. Drifting and benching constitute 18 % of the reserve design. The remaining 15 % of the reserve design comprises access development.

Figure 16.2 shows the final life of mine outline.

Figure 16.2: Final life of mine outline



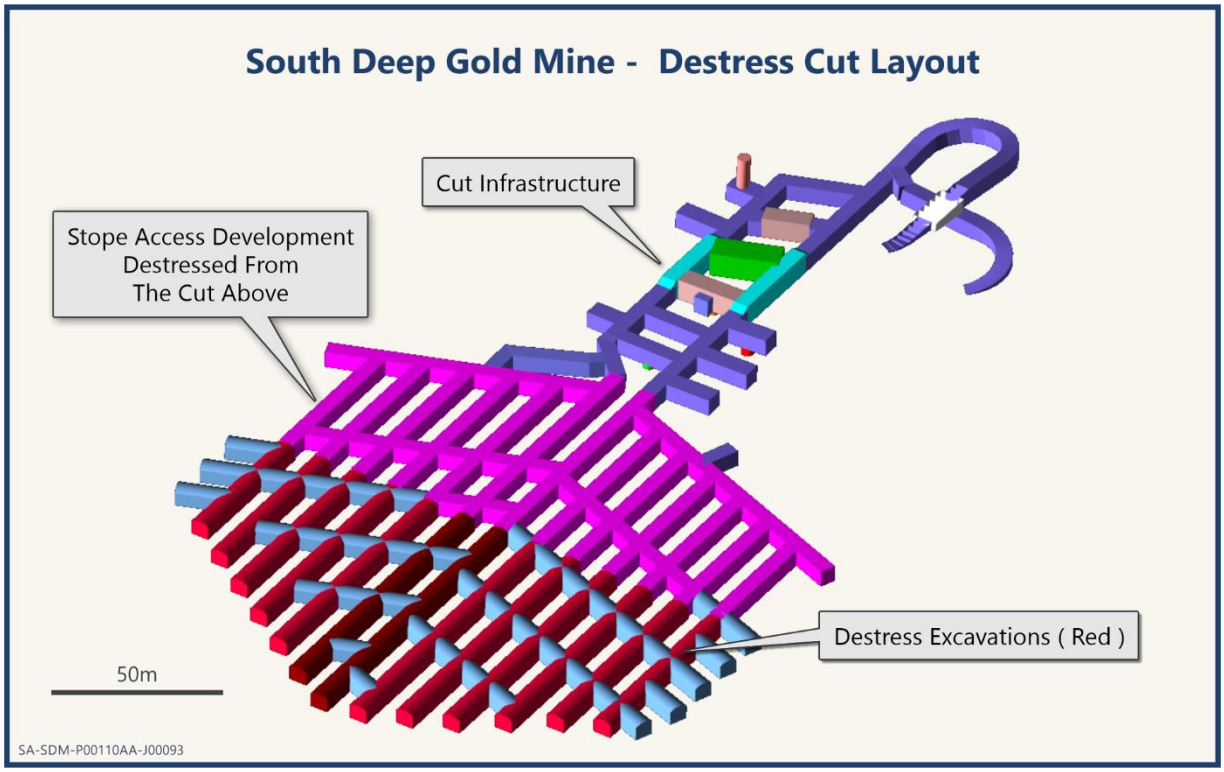
Source South Deep CPR 2021

16.2.1 De-stressing

At the current depth of mining (2,500 m below surface to 2,800 m below surface) rock stresses become exceedingly high. Stresses are aggravated dramatically with the large excavations associated with massive, mechanised mining activities, surpassing the rock strength and increasing the risk of rock burst. To combat this, the area is initially mined with smaller excavations to drive the high stress zone away from the large excavations and create a lower stress zone above and below the smaller excavation known as the de-stressed zone.

The de-stress cut is mined horizontally through the orebody on a grid pattern leaving yield pillars (Figure 16.3). These pillars then yield and transfer pressure in a reduced controlled fashion to the front of the advancing de-stress face. The de-stress cut is accessed from an access ramp system in the footwall of the orebody and the reef horizon is entered with two main access drives. The main access drives progress into the orebody and stope access drives are broken away at a 70 ° angle using a staggered pattern (blue). The stope access drives are then mined parallel to the main access drives in a southern directing (dip direction, red). The de-stress cut progresses in an arrow shape, maintaining a maximum lead/lag of 0 to 6 m towards the hangingwall contact of the orebody. Hollings are developed between the stope access drives on intervals of 15 m forming the yield pillars.

Figure 16.3: De-stress cut layout



Source: South Deep CPR, 2021

Since 2016 design improvements were made in both the de-stress cut design and access design. These changes not only reduce production risk but will also facilitate efficiency improvements. The 2021 life of mine de-stress design is based on a rib pillar layout with 15 m x 7 m pillars compared to the 2020 20 m x 8 m pillars. It also incorporates a twin cut access as opposed to a single access. This increases geotechnical stiffness and reduces development requirements. Each cut has a dedicated ore pass to reduce tramming distances.

Access to the de-stress cuts are gained via a single spiral ramp system and crosscut access development, comprising two access drives. The access development per cut provides for ancillary infrastructure which includes pass bays, ladderway cubbies, escape routes, refuge bays, truck loading bays, stores and maintenance bays.

The evolution of the de-stress method has resulted in a transitional zone from the start of NoW characterized by deteriorated ground conditions. Mining in this transitional zone has additional challenges and therefore mining rates, methods and extraction strategies. Risk associated with the mining challenges is further quantified into "metal at risk" as and when the plans are developed.

16.2.2 Stoping

LHS is the primary method of ore extraction. LHS is an efficient method to extract the large volumes required to mine the thick Upper Elsburg reef package. The method consists of a fan drilled radially from the stope access drive with hole lengths designed such that the resulting excavation envelope takes on a block profile. Five of these fans or rings are then drilled and blasted sequentially to break slices of rock forming the retreating face.

The broken rock is loaded and hauled by remote controlled LHDs to the closest available ore pass.

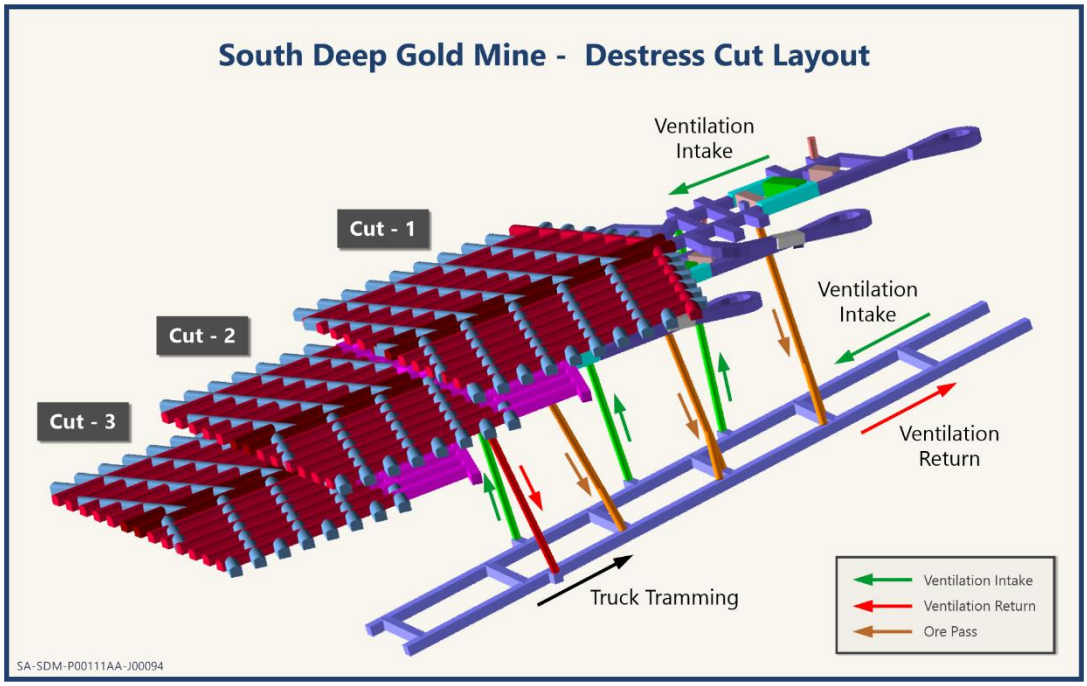
LHS is started from the stope access drives on the first stope access drive available for stoping and progressed sequentially to the front of the cut keeping a distance of three completed stope access drives from the advancing de-stress ends. When a stope is completely extracted the open void is backfilled. Once the backfill has cured, a neighbouring stope is mined. The stopes are backfilled continuously after extraction is complete.

16.2.3 Corridor infrastructure

The mining cuts and stopes are logistically supported by footwall declines (Figure 16.4) to provide:

- Rock handling with dump trucks hauling to a centralised crushing system from where it is transported by conveyor to the shaft.
- Corridor ventilation intake and return through separate vent-passes to affect an independent ventilation district for each cut.
- Water handling infrastructure and pumps.

Figure 16.4: North of Wrench footwall infrastructure



Source: South Deep CPR, 2021

16.3 Geotechnical considerations

The low-profile de-stressing method was converted into the high profile de-stress method in 2015, together with changing the regional pillar layout. The conversion process included significant design changes, much of which had not been trialled within a deep-level massive orebody before. Primary geotechnical considerations included in the mine design and scheduling process, together with geotechnical assurance processes are discussed below.

16.3.1 Regional pillar design

Regional pillar design is based on the work by SRK in 2015. The study assessed a combination of spans which resulted in the 60 m pillar, 180 m span combination being selected since it has the lowest seismic risk and relative deformation. However, a 60 m pillar, 240 m span has a negligible increase in seismic risk with regard to pillar energy release rates (ERR) and closure profiles are comparable. There is scope to consider increased strike regional corridor spans which may also favour rock mass stiffness and promote pillar crushing and de-stressing. Study work conducted by Malan (2020) indicated that larger corridor spans (up to 240 m) are possible without imposing higher ERR or regional pillar stress. Much of this can be attributed to the load carried by the crush pillars. Larger spans will also reduce the rock mass stiffness and promote pillar crushing and de-stressing.

16.3.2 In-cut pillar design

The low profile (LP) de-stressing method was converted into the high profile (HP) de-stress method in 2015 together with changing the regional pillar layout. The conversion process included significant design changes, much of which had not been trialled within a deep level massive orebody before. In 2020 the SAD orientated east-west mining layout was changed to a north-south orientated layout to accommodate the prevailing stress state and prominent bedding plane behaviour contributing to seismic related incidents.

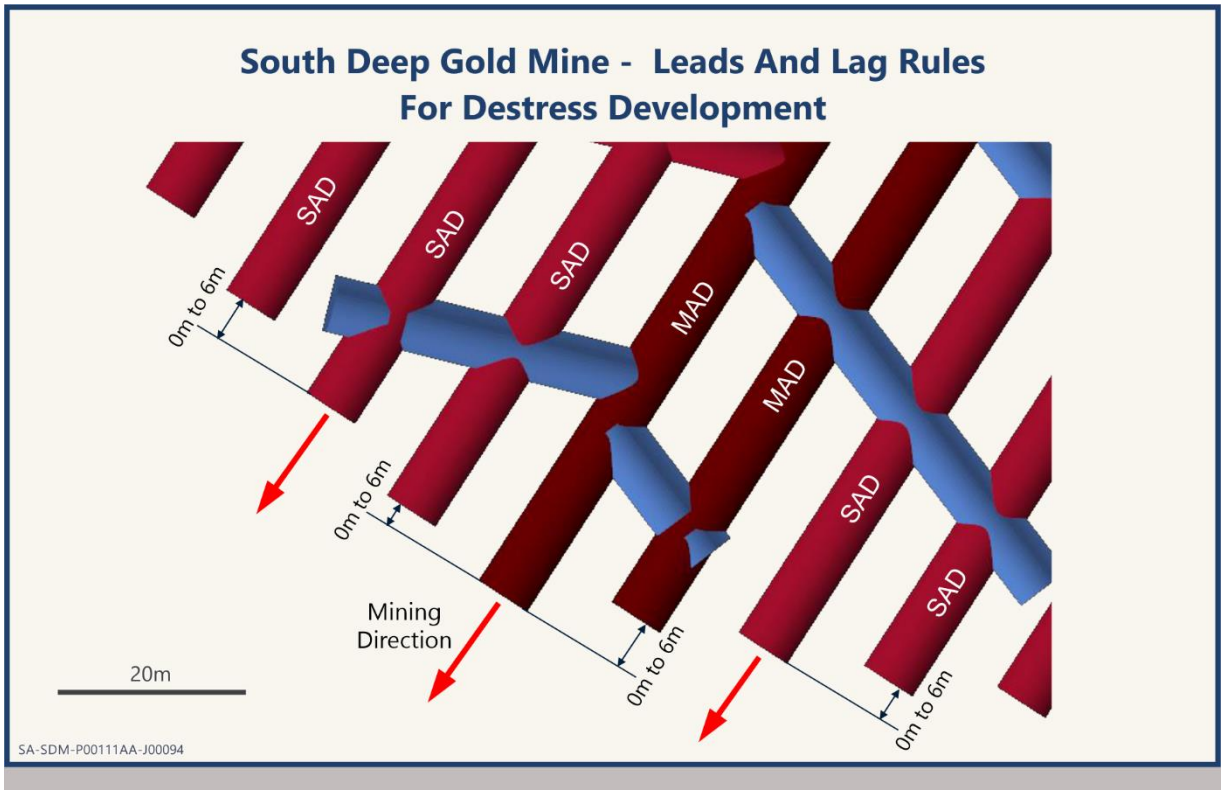
During 2019, shotcrete was introduced as part of the support cycle and pillar sidewalls were sprayed to approximately 2 m height. The shotcrete applied over the mesh has proven to be a successful pillar fracturing and seismic damage containment strategy. In 2020 shotcrete was extended to the hangingwall or the entire excavation is sprayed to mitigate the risk of seismic damage along stope access drives especially where problematic parting planes are intersected. Several projects are in progress to improve shotcrete availability, which will greatly support this strategy.

Based on new information following the work conducted in 2020, the de-stress crush pillar design was optimised to ensure that the pillars are effectively yielding as they are being formed to mitigate the risk of potential pillar bursts. The 7 m (L) x 15 m (W) pillars implemented have shown to successfully crush and yield when being formed.

16.3.3 Cut development geometry

Fixed rules on the development of the cut (leads and lags) are applied to ensure that no remnants are developed during the development phase of a de-stress cut and to ensure the systematic yielding of all the pillars in a cut. The specific lead and lags are given for the main access drive and stope access drive as shown in Figure 16.5.

Figure 16.5: Leads and lag rules for de-stress development



Source: South Deep CPR, 2021

16.3.4 Stope design

The LHS is the primary method of excavating reef at South Deep. This is a very efficient method to extract the large volumes required to mine the thick Elsburg Reef package. The method consists of a fan drilled radially from the SAD. Hole lengths are designed such that the resulting excavation envelope takes on a block profile. Hangingwall hydraulic radius methods is utilised to design stope sizes to optimise for extraction and stability. The stope hydraulic radius (HR) is based on past experiences and designed at circa 5.3. Currently, long-hole stopes could be situated under either competent rock, lava, old conventional stopes or backfill. Each stope design is therefore scrutinised to ensure an appropriate design is applied. These variations will be eliminated once stoping migrates to the current development cuts where there is no relics of the old mining methods, enabling improved extraction and optimised designs.

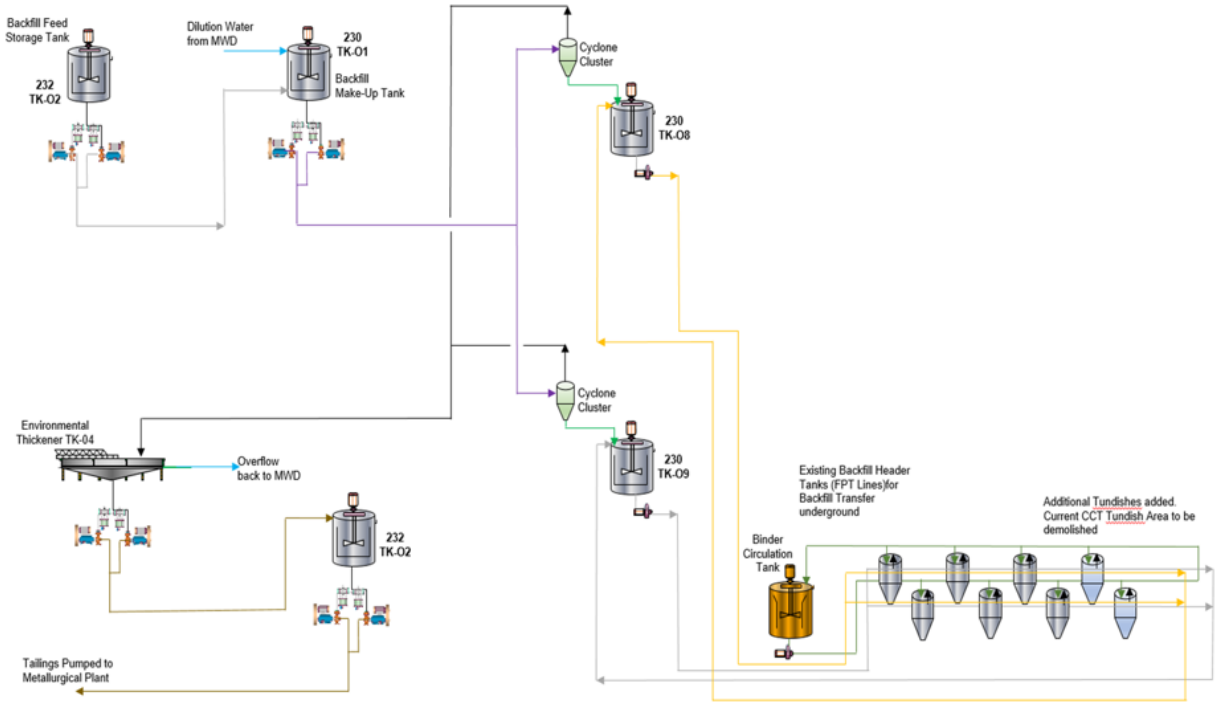
Initially stopes were extracted using a primary-secondary (P-S) extraction sequence. However, modelling (Lilley, 2016) indicated potential crushing of the secondary stope pillars making extraction difficult and predicted large Mineral Reserve losses. Based on field test results, the stoping sequence was changed to sequential stoping. Sequential stoping eliminates the secondary stope pillar; however, it requires disciplined backfilling.

With the current mining configuration as applied in 2020, there is a significant potential to optimise the stoping sequence, which may have a noteworthy impact on the production cycle.

16.3.5 Regional support (backfill)

Backfilling is a key component to ensure continued long-term operations at the South Deep mine (Figure 16.6).

Figure 16.6: Upgraded backfill semi-classified process flow diagram



Source: South Deep CPR 2021

The cyclone classified tailings (CCT) backfill system has been in operation since the late 1980s and was upgraded in 1998 to satisfy the mining plan requirement of 220,000 t/month. A study assessed a proposed mining plan upgrade from 220,000 t/month to 330,000 t/month and a change from conventional mining to the mechanised horizontal de-stress, LHS, drifting, and benching methods currently being used. The study concluded that the quantity of tailings required to produce CCT would not be sufficient to satisfy the backfilling requirement and that an alternative product was needed.

The study found that full plant tailings (FPT) as backfill material was suitable for use. A FPT backfill plant was designed to cater for the increased mining production of 330,000 t/month (assuming a utilization rate of 50 to 60 %). The surface FPT backfill plant, shaft ranges and an underground pressure break on 50 Level was constructed and installed in 2012 with full commissioning in 2019.

During 2019, testwork on the use of a singular product was carried out. The mine subsequently converted to a single product which is called semi-classified tailings (SCT). The product is similar to CCT and may contain more fines. The product provides much more consistent and improved performance compared to FPT. Ongoing testing is being conducted to further optimise the mix.

South Deep commenced retreatment of the old tailings dams in 2016 which resulted in more tailings being generated allowing the mine to classify the full product and still generate enough backfill.

The installed shaft and underground piping system will not be suitable to supply the SoW mining areas. A project plan will be developed to ensure the timeous installation of backfill infrastructure. Work is currently underway to optimise SoW access development, which will also consider backfill infrastructure.

16.3.6 Local excavation ground support design

Ground support is designed to take into account support resistance and energy absorption requirements. Support is designed to sustain a dynamic event of 3 m/s. Back analyses of rock burst events indicated that the previous bolt (Garford) was not effective, and a new bolt (Vulcan) was implemented in 2019 in all de-stress sections.

The Vulcan bolt is still an end-anchored bolt of which the long-term integrity relies on the effectiveness of the anchor and plate mechanism. The mine continuously conducts investigations to identify optimal support solutions with build-in continuous improvements on overall support system.

In addition to the bolts and mesh, shotcrete is applied in all de-stress excavations. The shotcrete applied over mesh has contained seismic induced damage and is therefore a successful damage containment strategy. Significant infrastructure and shotcrete developments have been made to apply pumpable shotcrete. The mine has invested in remote mechanized applications which will allow for the application of shotcrete prior to the primary support cycle.

Significant backlog on-reef support is now addressed and has placed the mine in an ideal situation where all required infrastructure which could impact on the life of mine plan is investigated in advanced, and all rehabilitation recommendations scheduled and executed timeously.

16.3.7 Seismicity

A seismic evaluation in 2020 found that the seismic energy released reduced significantly with stiffening of the pillar systems (regional span and increased pillar dimensions) even though the number of events has not significantly declined. The dimensions of the de-stress pillars have been refined and reduced slightly in 2021. This is further evident in the seismic hazard parameters which were stable over the period. The high-profile mining with the stiffer regional system appears to be safer than the previous wide span low-profile layout. Seismic events at the mine are observed to locate at the de-stress mining fronts and on regional stability pillars. Rock burst frequencies have improved/decreased from 2017 levels.

Several additional damage mitigation strategies were applied based on learnings from site investigations. Since 2019, in addition to the regular primary de-stress support, the pillar sidewalls in the stope access drives were sprayed with shotcrete. This was done to both contain the fractured pillar material and as a damage containment. Face preconditioning forms part of the mining cycle to mitigate the risk of face bursting. Face mesh is applied on all de-stress mining faces to contain damage on the advancing face, which has proven successful.

The implemented 7 m (L) x 15 m (W) pillars have shown to successfully crush and yield when being formed. Also, a north-south mining orientation was proposed and tested to mitigate the instances of sidewall bursting experienced with the east-west stope access drive configuration as well as hangingwall ride experienced along prominent parting planes.

16.3.8 Additional monitoring and governance

The monitoring program at South Deep consists of drillhole camera inspections, weekly support compliance audits and review of mining compliance to plan, monthly review of key performance indicators, quarterly closure laser monitoring and annual rating of the backlog support requirements. In addition, regular external governance reviews are undertaken every year by the GRB. The aim of this board is to review the geotechnical operational and design aspects and to provide assurance and guidance on the mine designs. The last GRB was held in October 2020.

The Australian Center for Geomechanics (ACG) conducted an independent external audit during 2019 on the seismic risk management practices applied on the mine. The findings were that the current processes on the mine ranked between standard to advanced when compared to the ACG system advocated by the GRB. The gaps identified were considered and addressed on a case-by-case basis. Independent and on-mine optimization projects were conducted in 2020 and will continue in 2021 to address anomalies regarding mine design, rock mass behaviour, support standards and behaviour as well as seismicity.

16.3.9 Qualified Person's opinion on geotechnical parameters

The Qualified Person's opinion is that all appropriate geotechnical parameters have been suitably considered and risk assessed to support the mining method selection and extraction sequencing and this information is embedded in South Deep's Geotechnical Management Plan which is routinely updated as new empirical information becomes available. The mine plan deemed to be geotechnically sound from a local and regional stability perspective based on current knowledge, modelling, levels of understanding and external and independent expert opinion.

16.4 Hydrological parameters

There are two sub-parallel north-south oriented dykes which crosscut the general South Deep area, which range in thickness from 10 m to 30 m. Although the dykes have low permeability, the contact zones with the host geology can be highly permeable. However, aquifer testing indicated that the permeability along the Gemsbok east dyke contact is heterogeneous and inconsistent.

There are three aquifers present in the area, including a) the upper weathered material, b) the competent and fractured rock material to a depth of 60 m to 80 m below surface, and c) the deep, confined, compartmentalised dolomitic (karstic aquifer) material. The weathered material aquifer has a thickness of around 5 m to 10 m, while the fractured rock aquifer can be active to depth of 80 m. The karstic dolomitic aquifer is associated with the deep confined compartmentalised dolomitic (karst) lithology. The aquifer underlies a thick succession of impermeable dolerite, shale and lava, some 400 m in thickness. This aquifer is not considered vulnerable to the tailing dams and other surface infrastructure. South Deep's underground workings are classified as dry with very little groundwater influx. The mine has a slightly negative water balance with makeup water obtained from Rand Water Board.

South Deep has a comprehensive monitoring program for groundwater quality around the mine. The scope of the monitoring program covers all the potential pollution sources and extends to neighbouring farming community.

South Deep uses DDScience and Rison Groundwater Consulting to sample surface and groundwater respectively. Samples are analysed at SANAS laboratories.

South Deep implemented a GoldSim dynamic water balance model. The model has both deterministic and probabilistic capabilities and can assist in the planning for requirements as during production ramp-up. The model was updated in 2021 to allow for facility level modelling.

The Qualified Person's opinion is that all appropriate hydrogeological parameters have been suitably considered and risk assessed to support the mining method selection and extraction sequencing and this information is embedded in South Deep's Geotechnical Management Plan which is routinely updated as new empirical information becomes available.

16.5 Mining fleet and machinery requirements

The list of equipment required for execution of the life of mine plan is in Item 15.2.4 and Table 15.5

The mining fleet is planned with the drill rig as the primary productive unit (development, de-stress and stoping) and units are allocated in accordance with geographic working areas, face availability, efficiency and excavation sequencing requirements. The load and haul fleet requirement is determined in accordance with efficiency expectations and the level of resource utilisation.

The focus for the face drill rigs is on maximising availability and reliability to enable them to perform to plan and to not compromise the overall mining cycle efficiency. The load and haul and backfill cycle times are also important to optimise to enable planned stope turnaround times to be achieved.

Non-standard units still in deployment will be phased out over time as the units reach the end of their useful life.

To achieve increased reliability of machinery, specialised teams per mining corridor have been created. Each corridor comprises of:

- Trackless mobile Engineer to facilitate and manage all the engineering teams in the respective corridor.
- Maintenance planner to facilitate planning, schedule routine services and manage parts provision in collaboration with the warehouse.
- Drill rig team to provide support to the development, de-stress and long-hole stopping machinery.
- Load and haul team to provide support to the LHDs and dump trucks.
- Utility team to provide support to all utility vehicles in the corridor.

Outsourced support teams to provide support to development, long-hole stope and bolter teams and to provide other teams with services and support on tyres, hoses and line boring

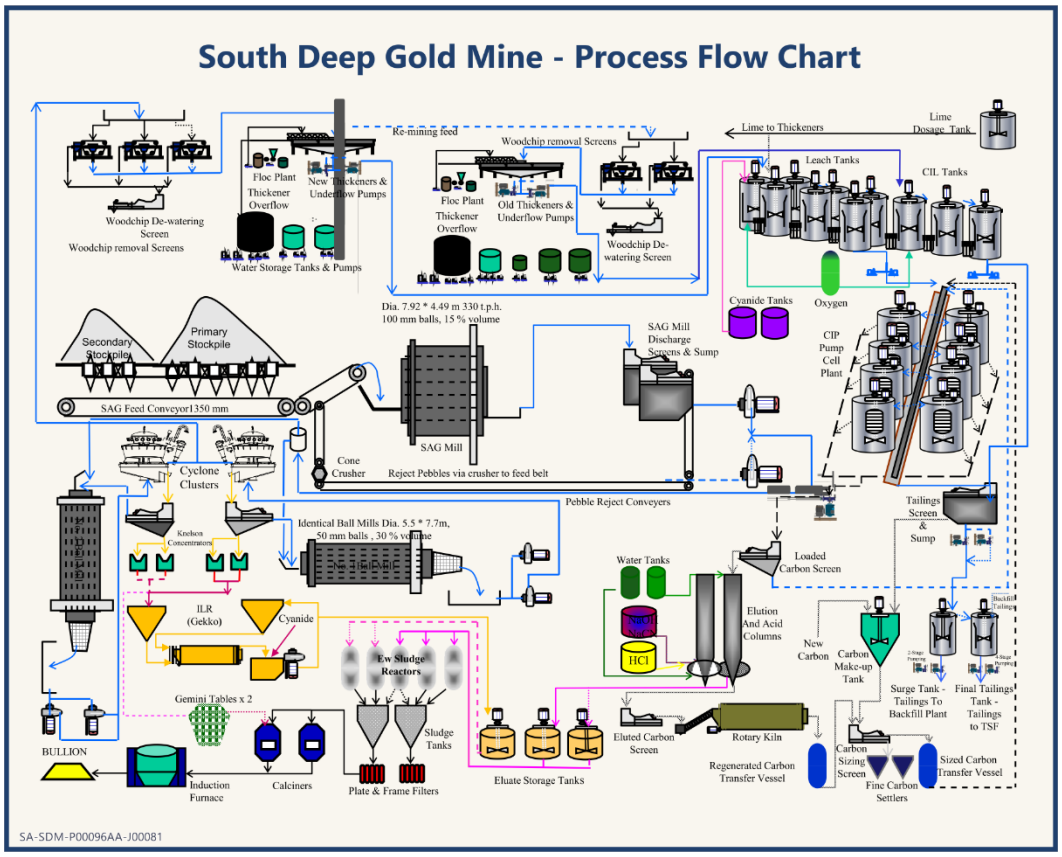
17 Recovery method

17.1 Flow sheet and design

The South Deep processing facility is designed to treat 330,000 tonnes of ore per month (circa 4 Mt per annum name plate) and currently treats a combination of underground ore and reclaimed tailings.

The plant incorporates a semi-autogenous grinding (SAG)/ball mill circuit with gravity recovery, thickening, leaching, CIP, elution and electrowinning technology. A schematic process flow sheet is presented in Figure 17.1.

Figure 17.1: Schematic flow diagram of South Deep process plant



Source: South Deep CPR, 2021

Ore is crushed underground (within the mine) and transported via two conveyor belts from the Twin Shaft Main and Vent shafts to the plant run-of-mine stockpile. Ore from the stockpile discharges via vibrating chutes onto the mill feed conveyor, feeding the primary SAG mill circuit.

17.1.1 Run-of-mine treatment

The primary SAG mill is closed with a pebble cone crusher, and the secondary milling is carried out in two ball mills closed with hydrocyclones.

The two ball mills are independent from each other allowing the plant to still operate at 220,000 t/month if either one of the ball mills is offline. The ball mills are in a closed circuit with a cyclone cluster with two Knelson concentrators for gravity recovery in each circuit. Concentrate from the Knelson concentrators reports to the smelt house where it is further upgraded using a Gemini Table and/or Gekko® InLine Leach Reactor (ILR). Currently approximately 25 % - 40 % of the gold is recovered through the gravity circuit, with the new ILR being successfully commissioned in 2021.

Classified milled product gravitates to linear screens for woodchip removal. The woodchips are dewatered on a vibrating screen and sold as a by-product. The final pulp gravitates to a high-rate thickener. Thickener underflow is pumped to the leach section and the clear thickener overflow is re-used as process water in the plant.

The leach section consists of seven mechanically agitated tanks each with a capacity of 3,000 m^3. The first two tanks have an oxygen injection system to ensure dissolved oxygen levels are adequate during the leaching process. Cyanide is added to the first leach tank with provision for manual dosing down the leach train. A system is available to add lime to ensure protective alkalinity. Leached pulp is pumped via a surge leach tank to the CIP pump cell feed launder.

The CIP section consists of eight individual pump cells, each with a capacity of 200 m^3. Gold is adsorbed onto the carbon in each tank, with the final tails reporting to a carbon scavenging screen before disposal to tailings. The carousel arrangement of the pump cell allows for a specific head cell to be offline at any time. The entire contents of the cell are pumped out over a vibrating screen. The screen undersize is returned to the CIP feed launder and the loaded carbon is collected for elution.

The elution sequences are carried out in two columns. The elutriation, acid soak and water wash sequence are carried out in one column (acid column) while the pre-heat, caustic cyanide soak, hot water elution and cooling steps are carried out in the second column (elution column). Carbon is then transferred to the kiln for regeneration in an electrically fired rotary kiln and screened to remove fines before reuse in the CIP circuit. Undersize carbon reports to settlers and is collected in bulk bags and taken off site for by-product gold recovery. The high-grade solution (eluate) from the elution process is transferred into two eluate storage tanks just outside the smelt house.

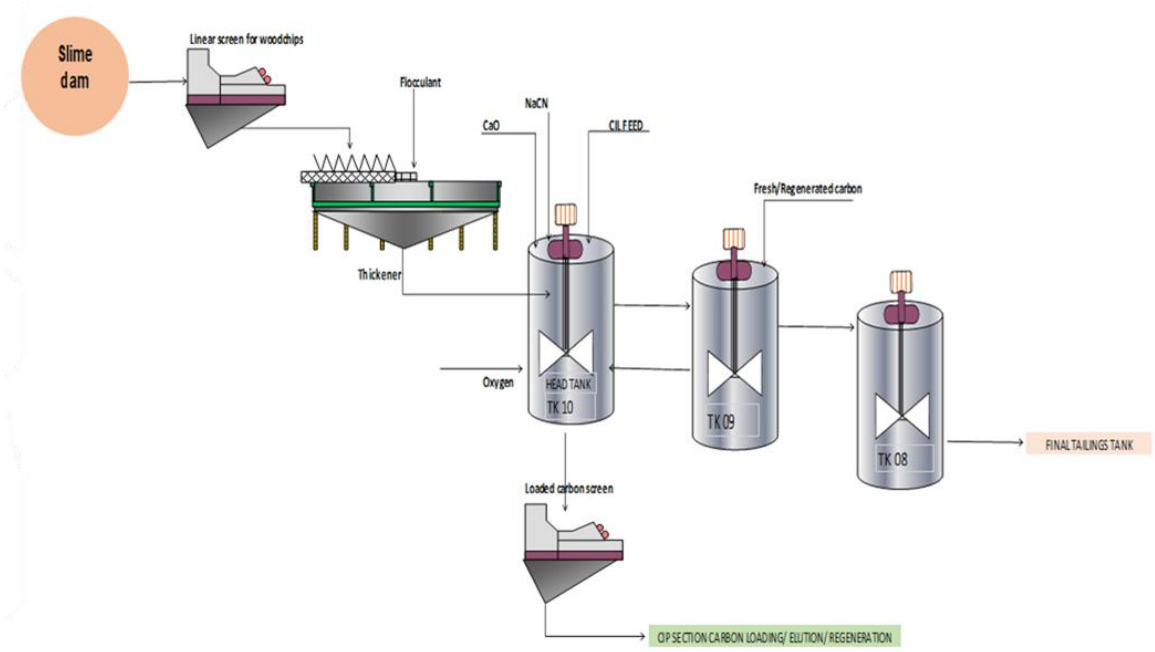
Eluate solution is circulated through three of five sludge reactors for electrowinning of gold. The reactor sludge is filtered, dried and smelted in an induction furnace to produce doré bars. Spent electrolyte is returned to the leach section. Pregnant solution from the ILR is circulated through two sludge reactors for electrowinning of gold. Sludge from the dedicated gravity circuit reactors is filtered, dried and smelted in the induction furnace to produce doré bars. Barren electrolyte is returned to the leach section. In the event the ILR is unavailable gravity gold is recovered using a Gemini table and the table concentrate directly smelted in an induction furnace to produce doré bars.

17.1.2 Tailing retreat

Three leach tanks were converted to CIL contactors to facilitate recovery of tailings from the dormant TSFs. Hydraulically re-mined material is screened, thickened and leached in the three CIL contactors which are retrofitted leach tanks of 2,800 m^3 capacity (Figure 17.2). The CIL tail is combined with the underground ore CIP tail and pumped to the backfill plant situated at the South Shaft complex or to the Doornpoort TSF. Carbon from the CIL circuit is periodically stripped in the existing elution facility. Sampling of the CIL circuit for metal accounting purposes is carried out using automated samplers. The retreatment of tailings also ensures sufficient tailings are available for backfill production.

The re-mining section has been set up to treat a maximum of 150,000 t/month using hydraulic mining with the re-pulped product screened to remove any coarse particles prior to being pumped to the process plant. At the plant, the material is screened using two linear screens and then thickened prior to being pumped to the leach section. The head grade of the TSF material averages approximately 0.22 g/t Au with a recovery of approximately 46 %.

Figure 17.2: South Deep TSF re-mining process flow



Source: South Deep CPR 2021

17.2 Recent process plant performance

The recent performance of the South Deep process plant is provided in Table 15.1.

17.3 Process plant requirements

The key process plant requirements for the first seven years of the Mineral Reserve life of mine plan are summarised in Table 17.1.

Table 17.1: South Deep process plant – key requirements summary

Parameter		2022	2023	2024	2025	2026	2027	2028
Underground ore processed	(kt)	1,928,561	2,242,197	2,609,470	2,655,345	2,580,385	2,390,797	2,268,411
Surface ore processed	(kt)	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
Total ore processed	(kt)	3,128,561	3,442,197	3,809,470	3,855,345	3,780,385	3,590,797	3,468,411
Plant power draw	(MWh)	68,515	75,384	83,427	84,432	82,790	78,638	75,958
Sodium cyanide	(t)	1,428	1,571	1,738	1,759	1,725	1,639	1,583
Grinding media	(t)	3,857	4,484	5,219	5,311	5,161	4,782	4,537
Lime	(t)	2,743	3,018	3,340	3,380	3,314	3 148	3,041
Caustic	(t)	307	338	374	379	371	353	341
Activated carbon	(kt)	188	207	229	231	227	215	208
Hydrochloric acid	(t)	173	190	210	213	209	198	192
Peroxide for CN detox	(kℓ)	417	459	508	514	504	479	462
Oxygen	(kt)	3,129	3,442	3,809	3,855	3,780	3,591	3,468
New fresh water	(t)	360,000	360,000	360,000	360,000	360,000	360,000	360,000
Plant employees	(No.)	148	148	148	148	148	148	148
Plant contractors	(No.)	82	82	82	82	82	82	82

Source: South Deep CPR 2021

Major projects planned for the process plant include an upgrade to the underground paste backfill plant as the infrastructure at the backfill plant is old and structurally in poor condition. All redundant equipment will be removed, new tanks installed where required and the plant layout simplified.

17.4 Processing risks

17.4.1 Major equipment failure

Industrial mineral process plants consist of a series of dedicated unit processes, e.g., crushing, grinding, leaching, CIP, and carbon elution. There is inherent risk associated with catastrophic failure of one (or more) of the key equipment items associated with these unit processes, whereby such failure could lead to a significant period of plant downtime until repairs are completed, resulting in the inability of the processing plan or forecast to be achieved and/or incurring higher operational costs than anticipated.

Catastrophic failures could be associated with the structural, mechanical, or electrical components of the key processing equipment items. Key equipment items include the grinding mills, or leach/CIP tanks.

Risk minimisation activities includes:

- Plant steel and concrete monitoring and refurbishment program.
- Dedicated on-site maintenance department which undertakes condition monitoring, preventative maintenance, and repairs.
- Critical spares holding (e.g., spare mill motors, gearboxes, and girth gear).
- Contingency operational plans (e.g., operating stand-by ball mill, leach/CIP tank by-passing).
- Fire suppression systems.

Decisions associated with asset management, critical spares, insurances, etc. are outside the responsibility and accountability of the Qualified Person, and some inherent risk and uncertainty associated with catastrophic failure of processing equipment remains.

17.4.2 Plant operational management

The processing facilities are managed and operated by dedicated teams of personnel, who are required to make many operational and maintenance decisions every day. These decisions can directly impact the performance of the plant while processing ore reserves.

For example, a decision to process ores at a higher throughput could result in a coarser grind size from the grinding circuit, resulting in a lowering of the plant recoveries. Similarly, the choice to operate the leaching circuit at lower free cyanide or dissolved oxygen concentrations to reduce consumables usage rates, could result in lower plant recoveries.

Plant management and the associated decisions made by plant operating personnel, are outside the responsibility and accountability of the Qualified Person, and such decisions and actions taken by plant management can influence the achieved performance of the plant (e.g., throughput, costs, availability, and recoveries).

17.4.3 Operating costs, plant consumables and reagents

The operating cost of the process plant represents a significant cost element to the overall financial evaluation of the Mineral Reserve's life of mine plan. The processing facilities use relatively large quantities of power, reagents and consumables, cyanide, grinding steel media, lime, caustic, etc.

The estimation of future processing costs is required as input into the cut-off-grade calculations and economic assessments of the Mineral Reserves and Mineral Resources. Cost estimation requires inputs from anticipated production volumes.

Metallurgical testing undertaken on the Mineral Reserves, and recent plant performance, provides reasonable guidance of potential reagent consumption rates and mill throughput expectations, and this information is considered and reviewed by the plant metallurgist and the Qualified Person.

South Deep, like many other operating gold process plants that have a reasonable operating history, do not allow for a discreet operating cost contingency in their future operating cost forecast. The absence of contingency is considered by the Qualified Person as being a common and reasonable approach to operational process plant cost forecasting.

Commodity price and inflation are subject to external influences that are outside the control or predictive capability of the Qualified Person.

Unexpected variances in the nature of the ore being processed could unexpectedly impact reagent and consumables usage rates. Such variances are outside the control or predictive expectations of the Qualified Person.

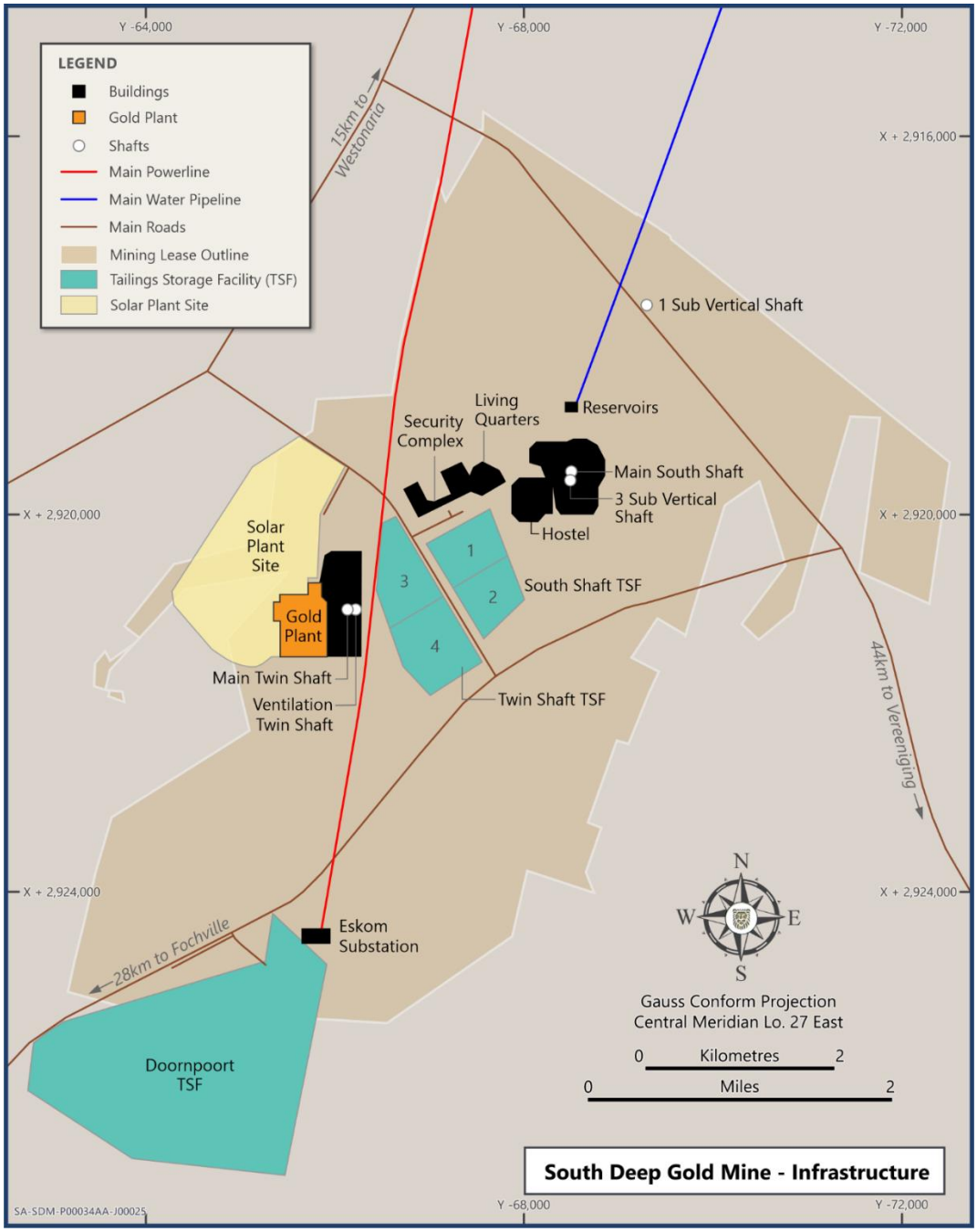
The Qualified Person's opinion is that all appropriate key parameters have been suitably considered to support the processing and recovery methods incorporated in the South Deep life of mine plan. The processing flow sheet, plant design, equipment and specifications are all within demonstrated operating ranges experienced at the mine over an extended operating history.

18 Project infrastructure

18.1 Non-process infrastructure

Details on each major item of non-process infrastructure are discussed below. The site infrastructure layout is shown in Figure 18.1.

Figure 18.1: South Deep surface infrastructure



Source: South Deep CPR 2021

18.2 Tailings storage facilities (TSF)

South Deep has three tailings storage facilities:

- South Shaft (TSF 1 & 2)
- Twin Shaft (TSF 3 & 4)
- Doornpoort.

TSFs 1 and 2 were commissioned in 1968 as upstream raised paddock dams covering a combined footprint of 69 hectares (ha), having a maximum height of 30 m for TSF 1 and 27 m for TSF 2 (Figure 18.2). Deposition on these TSFs ceased in 2011. However, TSF 1 and TSF 2 are actively reclaimed using high-pressure water cannons to create a slurry pumped to the gold plant for processing. TSFs 1 and 2 have a High B consequence classification rating under the Australian National Committee on Large Dams (ANCOLD) guideline.

Figure 18.2: TSFs 1 and 2

Source: South Deep CPR 2021

TSFs 3 and 4 were commissioned in 1982 and are also upstream raised paddock facilities covering a combined footprint of 100 ha and have a maximum height of 41 m (Figure 18.3). Deposition on these TSFs ceased in 2011. Both TSFs have a High C consequence classification rating in accordance with ANCOLD.

Figure 18.3: TSFs 3 and 4

Source: South Deep CPR 2021

SLR Consulting designed the Doornpoort TSF, RWD and associated water infrastructure in 2008/2009 in a joint venture with Golder Associates. Phase 1 of the Doornpoort TSF and associated infrastructure was constructed between 2009 and 2011 and was commissioned in April 2011. SLR Consulting is also the Engineer of Record (EoR) for the South Deep TSFs. The Doornpoort TSF is shown in Figure 18.4.

Figure 18.4: Doornpoort TSF

Source: South Deep CPR 2021

The approved design of the Doornpoort TSF is based on upstream raising utilizing the previously deposited tailings material for the individual raises at an outer side slope of 1V:4H to a maximum design height of 78.4 m and a maximum design rate of rise of 1.6 m/year. The Doornpoort TSF has a High C consequence classification rating in accordance with ANCOLD.

The South Deep TSFs must comply with the Global Industry Standard on Tailings Management (GISTM) by August 2025. A gap analysis has been completed, and the GISTM compliance program is underway in collaboration with the EoR.

The Qualified Person is of the opinion that the infrastructure for the South Deep mining operation is fit for the life of mine Mineral Reserve estimation and that the Mineral Reserve quantities are tested against dump and disposal capacities.

Given the relatively long mine life associated with the South Deep Mineral Reserves, it is possible that industry design and practice guidelines and/or local regulations concerning tailings storage facilities could change, which may result in some modifications being required to be implemented at additional cost.

18.3 Waste rock dumps

South Deep mills all ore from underground. By-product that is not utilised for backfilling is then deposited to the Doornpoort TSF.

18.4 Water

The approved 2011 WUL was amended and submitted as an integrated water use licence (IWUL) during May 2015. South Deep was issued with a new WUL on the 19 November 2018. South Deep reviewed its water management plan to align with the new licence.

Water management at South Deep is continuously reviewed to ensure compliance with the current approved 2018 licence conditions and the GN704 regulations. An extensive water monitoring program is in place and has been reviewed to align with the 2018 licence. Toxicology monitoring was introduced at some of the bio-monitoring points. Groundwater monitoring is done on both mine and neighbouring farmers' boreholes. Annual compliance against the licence conditions was conducted in 2020, and there were no findings raised against the mine.

Independent studies have indicated there is no requirement for post-closure treatment of underground mine water at South Deep. All other recommendations from the report have been incorporated into the life of mine. The independent studies report was further peer reviewed by another independent service provider to ensure its integrity and robustness . Integrated Water and Waste Management Plan (IWWMP), the mine's closure plan as well as the annual closure estimated costs have been incorporated in the life of mine.

At present, South Deep is a nett consumer of water and does not produce surplus water. Other environmental initiatives are focussed on responsible use and management of water (including water reuse and recycling optimisation projects and scavenger wellfields for pollution control).

18.5 Power

Power is supplied from the dual Eskom (South Africa's national electricity utility) network at the Twin Shaft and South Shaft Complexes. The Twin Shaft complex has 160 MVA capacity with a 2018 notified maximum demand of 54.5 MVA, while the South Shaft Complex has 120 MVA capacity with a 2019 notified maximum demand of 55 MVA. The installed Eskom capacity is sufficient for the production build-up and steady state annual production (12 t Au) over life of mine Mineral Reserves.

South Deep has an emergency diesel powered generating plant with a capacity of 21 MVA to ensure the main winder and one main ventilation fan can be powered and operated during a complete blackout of the national power supply. This is to ensure safe evacuation of underground personnel and the operation of pumps to ensure the mine does not flood.

South Deep developed a five-year energy security plan during 2015 to manage power supply risks. Electricity contributes to 95.3 % of the operation's energy consumption and 96.3 % of the carbon emissions. To mitigate power supply risk and in line with our decarbonization commitments, construction of the 40 MW solar photovoltaic (PV) power generation plant commenced and approval to increase output to 50 MW is in progress. Commissioning of the plant is scheduled for Q3 in 2022.

18.6 Accommodation

A revised housing strategy was approved in 2021 which intends to have an inclusive accommodation approach. The South Deep Housing Policy aims to enable employees to access good quality and affordable accommodation for either rental or ownership within reasonable daily commuting distance to South Deep.

18.7 Administration

Mine services are administered on site with all key personnel based at the mine offices. The mine is equipped with on-site health and emergency facilities. Human resource development is administered through on-site training centres that have state of the art virtual reality facilities.

18.8 Site access

South Deep is accessed via the N12 provincial road between the city of Johannesburg and the town of Potchefstroom. International access is via either the O.R. Tambo and Lanseria international airports east and north-west of Johannesburg respectively.

18.9 Maintenance

The following trackless equipment workshops are established on surface and underground to support South Deep's maintenance regime:

- Surface refurbishment workshop.
- Main underground workshop; a large facility located on 93 Level for the next few years.
- Satellite workshops: five workshops located on 90, 93, 95 and 100 Levels to service production areas located significant distances from the main underground workshop.
- Cut workshops: planned for future strategic production areas near de-stress areas in the NoW mining area. They are smaller, more efficient facilities based on 93 Level.

18.10 Headframes and winding systems

South Deep consists of two surface shaft complexes, South Shaft and Twin Shafts. Twin Shaft Complex has Main Shaft (for personnel, material, services and rock hoisting) and the Ventilation Shaft (for rock hoisting, services and return ventilation). South Shaft Complex has Main Shaft (for personnel, material, services and return ventilation), South SV1 Shaft (not active), South SV2 Shaft (for services), South SV3 Shaft (for personnel, material and services) and access development on five active levels.

18.11 Ventilation

The mine ventilation system consists of shaft and main fan infrastructure from both Twin Shaft and South Shaft Complexes, which form a combined system to supply approximately 1,700 kg/s required to effectively ventilate the mine at a maximum rate of 275,000 t/month.

There are surface refrigeration systems at both shafts. The refrigeration plant on Twin Shaft mainly provides chilled water to the surface bulk air cooler, ensuring that the bulk of the downcast air is cooled to provide the correct base temperatures for the underground sections. The configuration of the refrigeration plant at South Shaft is designed to cool water for the surface bulk air cooler at South Shaft as well as the water distributed to the underground cooling and services. All the water sent underground is provided from this refrigeration plant. The underground cooling at Twin Shaft is supplied from a refrigeration plant installed on 94 Level.

During a later stage of the life of mine plan, additional cooling will be provided by a new refrigeration plant planned for installation on 80 Level.

18.12 Backfill plant

Tailings from the process plant is pumped at a density of about 1.4 t/m^3 to a storage tank at the backfill plant at South Shaft. Tailings from the storage tank is pumped into the backfill make-up tank, with water added to reduce the slurry density to about 1.2 t/m^3. The slurry is fed through a cyclone cluster to produce a SCT backfill product from the cyclone underflow at a density of about 1.8 t/m^3 which is stored in two batching tanks. The cyclone overflow is pumped to the Doornpoort TSF via the process plant.

The SCT product is tested for weak acid dissociable (WAD) cyanide levels (which should be below 50 ppm) using an on-line WAD 1000 analyser. The particle size distribution is checked (15 % passing 10 µm) using a Malvern Mastersizer. Slurry and cement binder are circulated in a ring main around the tundishes which allow the two products to be blended before gravitating to underground. Binder addition is between 6 % and 10 % to ensure the correct strength backfill is placed underground.

19 Market studies and contracts

19.1 Preliminary market study

The majority of gold production is used for jewellery and for investment purposes, in the latter case because the market views it as a store of value against inflation. In addition, certain physical properties of gold, including its malleability, ductility, electric conductivity, resistance to corrosion and reflectivity, make it the metal of choice in a number of industrial and electronic applications.

Supply of gold consists of new production from mining, the recycling of gold scrap and releases from existing stocks of bullion. Mine production represents the most important source of supply, typically comprising 75 per cent. each year. Annual demand requires more gold than is newly mined and the shortfall is made up from recycling. Management considers that long-term gold supply dynamics and global economy trends will support the gold price at levels above or aligned to $1,300 per ounce in the long-term.

The market for gold is relatively liquid compared to other commodity markets, with London being the world's largest gold trading market. Gold is also actively traded via futures and forward contracts. The price of gold has historically been significantly affected by macroeconomic factors, such as inflation, exchange rates, reserves policy and by global political and economic events, rather than simple supply/demand dynamics. Gold is often purchased as a store of value in periods of price inflation and weakening currency. The price of gold has historically been less volatile than that of most other commodities.

19.2 Gold metal pricing

A review of metal prices for planning purposes is undertaken annually to monitor any significant changes in price trends or exchange rates that would warrant re-calibrating the price deck before the Strategic Planning process transitions into the Business Planning cycle.

This review of the metal price deck has taken account of the prevailing economic, commodity price and exchange rate (Fx) trends, together with market consensus forecasts, in addition to consideration of the Gold Fields' strategy and expectations for the operations.

The Company's strategy is to (1) mitigate annual volatility by holding planning metal prices as long as warranted to support stability in mine planning, notably regarding the underground MSO and open pit shell selections; (2) maintain appropriate margins on spot and long-term price forecasts to support the Group's business model; (3) protect against accelerating mining sector inflation and, (4) to confirm a separate gold price to be used specifically for the Operational Plan (budget) revenue streams and cash flows in Q3 each year.

The outcome of the pricing analysis was to use a gold price of $1,300/oz for Mineral Reserves and $1,500/oz for Mineral Resources for the December 2021 disclosure of estimates (Table 19.1).

Table 19.1: Gold price assumptions

Metal	Unit	December 2021 metal price deck	
		Mineral Reserve 31 Dec 2021	Mineral Resource 31 Dec 2021
Gold	US$/oz	1,300	1,500
	ZAR/kg	650,000	750,000

Source: South Deep CPR 2021

The above price deck comparable to long-term market forecasts assessed at the time of analysis is consistent with the Issuer's approach to retaining good discipline in support of the Company strategy; this approach ensures Gold Fields' Mineral Resources and Mineral Reserves have low volatility year-on-year and that the Company is protected against possible downside scenarios if the gold price falls up to circa 25 % in any specific year. Ensuring sufficient margins at prices that could be incrementally lower than the spot price ranges seen in 2021 is also important. Equally, with annual mining sector inflation estimated at $30-40/oz, we need to ensure we mitigate this escalation risk in the life of mine plans and Mineral Reserve estimates.

Sensitivity analysis on gold price for project financial evaluation is done to provide flexibility/range analysis for all regional studies and site growth opportunities and investment purposes.

The Mineral Resource gold price premium to the Mineral Reserve price is circa 15 % and the differential is in general alignment to our peer group and industry standard practice. The Mineral Resource price premium is to provide information on each operation's potential at higher gold prices and to indicate possible future site infrastructure and mining footprint requirements.

All gold produced from South Deep is shipped to the Rand Refinery in Johannesburg. On completion of refining, the gold bullion is sold on the established world gold market through Gold Fields Corporate Treasury. Gold Fields' treasury department in the corporate office in Johannesburg, South Africa sells all the refined gold produced by the operating company. On collection of the unrefined gold from a mine site, the relevant operating company will notify Gold Fields' treasury department of the estimated refined gold content, expressed in troy ounces, available for sale. After such confirmation, the treasury department sells the refined gold to authorised counterparties at a price benchmarked against the London Bullion Market Association PM gold auction price.

Gold Fields may periodically use commodity or derivative instruments to protect against low gold prices with respect to its production. Variations in gold price, currency fluctuations and world economics can potentially impact on the revenue received. No derivative instruments are in place at the date of this report.

The Qualified Person has relied on information provided by the Company in preparing its findings and conclusions regarding market studies related to gold sales from South Deep. Refining services are based on well-established long-term agreements and expediting gold sales over the life of the asset does not represent any significant uncertainty. Service contracts, lease agreements and goods contracts e.g., diesel, cyanide and cement, necessary to develop the property as planned, are in place and have the capability to support the full projected cash flow period.

19.2.1 Metal price history

Gold prices London Metals Exchange afternoon close:

- Gold spot 30 December 2021 - $1,805.85/oz – ZAR28,175.50/oz
- Fx 30 December 2021 ZAR15.60:$1.00
- Gold spot 24 month average - $1,784.45/oz (ending 31 December 2021)
- Gold spot 36 month average - $1,653.71/oz (ending 31 December 2021)
- Gold spot 60 month average - $1,497.48/oz (ending 31 December 2021).

20 Environmental studies, permitting and and social or community impact

Climate change is an integral part of the Mineral Reserve generation process and incorporating relevant costs associated with climate change, primarily decarbonisation, mitigation and adaptation to the changing climate, is a key theme for the Company. Integration of these key elements into the Mineral Reserve process is being carried out progressively and simultaneously across all of Gold Fields' sites.

20.1 Environmental studies

A Climate Change Risk and Vulnerability assessment was completed during 2021. The key findings were increased temperatures and period of less rainfall and higher storm events, this will likely result in drought and flooding. An action plan has been put in place to manage the risks in core operations and upstream value chain during flood events.

South Deep conducts an Environmental Authorisation (EA) independent external audit on biennial basis as a legal requirement. The EA is conducted in terms of regulation 34 of the 2017 National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) regulations. The audit covers all the authorizations including Environmental Management Program Report (EMPR), WUL, AEL, Biodiversity Permit and Waste Licence. The latest audit was conducted in 2020 and South Deep achieved a compliance rating of 97 %. There was one non-compliance issue relating to the update of the Biodiversity Management Plan (BMAP) and two partial non-compliance issues relating to Heritage and Visual Management Plan. South Deep is currently updating the BMAP and is scheduled to be completed by June 2022. All the graves identified by the archaeologist on site, have been fenced off and are maintained on a quarterly basis. A program is underway to plant trees at Doornpoort TSF as a barrier for visual impact. A specific EA was obtained with respect to South Deep's solar plant, and all conditions attached to the authorisations are being adhered to and tracked on a weekly basis.

The update of the 2016 Biodiversity Management Action Plan is underway to align with the Group reporting guidance, it is envisaged that the update will be completed in 2022.

The Qualified Person is of the opinion that the closure and environmental studies are in good standing and are not seen as material to the life of mine Mineral Reserve.

20.2 Waste disposal, monitoring and water management

20.2.1 Tailings storage facilities (TSF)

The Twin Shafts TSFs (TSF 3 and TSF 4) are currently under care and maintenance with no deposition onto the TSFs. The freeboard survey for the Twin Shaft TSFs was carried out in June 2021, and both TSF 3 and 4 comply with the GN 704 and ANCOLD freeboard requirements.

The freeboard survey for the South Shaft TSFs was carried out in June 2021. It should be noted that the South Shaft TSFs (TSF 1 and TSF 2) are assessed as a combined TSF, and therefore the freeboard assessment is undertaken for the TSF as a whole and not reviewed individually. Based on the assessment, the South Shaft TSFs comply with both the GN 704 and ANCOLD freeboard requirements.

The most recent stability assessment undertaken by the EoR for all the TSFs indicated no real concerns, provided the facilities are operated in accordance with the Code of Practice and the Operating and Surveillance Manual.

An independent groundwater consulting firm is contracted to evaluate the impact of South Deep's mining operations on the groundwater environment. This is done quarterly by sampling and analysing numerous groundwater-monitoring boreholes placed strategically across the mine property and selected privately owned boreholes on surrounding farms. The sampling points may vary between sampling intervals as some boreholes dry up occasionally or are damaged beyond repair. The groundwater samples are collected in accordance with the recommended guidelines and analysed by a SANAS accredited analytical facility.

The groundwater monitoring results for the South Deep monitoring boreholes (Twin Shaft, South Shaft, TSFs 1&2, metallurgical plant) indicate that static water levels have been relatively consistent over time and show somewhat similar trends with a definite seasonal response. This indicates that South Deep's mining activities have had no negative influence on the local water levels.

Progress is made in achieving an objective of maintaining the depth of water level at 6 meters below ground level (mbgl), owing to the pumping of the scavenger wellfield at Doornpoort.

The Q3 2021 report shows no significant change to groundwater quality in all groundwater monitoring points. However, the results show a localised groundwater impact within the vicinity of the pollution sources. Furthermore, pollution interception boreholes have been installed to pump and reuse impacted groundwater in the mine processes. The recent geohydrological study shows pollution plumes will continue to be localised over the life of mine with continued pumping.

The South Deep process plant currently deposits tailings onto the Doornpoort TSF.

The initial Doornpoort TSF design was based on a total of 330-kilo tonnes per month (ktpm) and a maximum rate of rise of 1.6 meters per year (m/yr.) over a 50-year life of mine. The Doornpoort TSF was later modified to receive only 220 ktpm. At a production of 220 ktpm, a total tonnage of 132 Mt over 50 years will be achieved. The original design allowed for a total tonnage of 198 Mt (at a production rate of 330 ktpa over 50 years). Although the TSF was initially designed for 198 Mt, an additional capacity of 7 Mt was included in the design, increasing the tonnage which the TSF can contain up to 205 Mt.

The life of mine deposition requirement as of January 2021 is 206 Mt plus ~47 Mt of retreated tailings less ~76 Mt used as backfill. This equates to 177 Mt to be deposited. The remaining storage of the TSF is currently estimated at 178 Mt. The TSF, therefore, has adequate storage capacity.

The Phase 1 development is now approaching its design capacity. Therefore, based on the current life of mine plan, including assumptions for re-mining and backfill requirements, the Phase 2 expansion construction commenced in May 2021, with completion expected during Q3 2022.

20.2.2 Waste rock dumps

South Deep Mine mills all ore from underground, by-product that is not utilised for backfilling is then deposited to the Doornpoort TSF.

20.2.3 Water management

Refer to Item 18.4 for details on water management.

20.2.4 Other monitoring

Other environmental initiatives are focussed on responsible use and management of water (including water reuse and recycling optimisation projects and scavenger wellfields for pollution control), air (including dust control) and mine closure management, as well as maintaining the licence to operate through regulatory compliance.

South Deep has two stacks (from the kiln and the smelter house). The Company conducts stack emissions surveys annually as per its Atmospheric Emissions Licence (AEL). In 2021, the mine through independent external service provider, conducted a stack emission survey. The objective of the measurement program was to quantify the parameters and emissions from a single point source and where these were non-compliant, corrective measures were then put in place and applied. The stack emission survey parameters are noted below.

Stack ID Kiln 1 stack parameters include:

- Gas velocity
- Gas volumetric flow rate

- Gas temperature
- Gas static and absolute pressure
- Moisture content
- Isokinetic emissions, such as particulate matter (PM)
- Anisokinetic emissions (instrumental monitoring) such as combustion gas components (O2, NO, NO2, NOx, CO, CO2 and SO2).

Stack monitoring results are shown in Table 20.1.

Table 20.1: Stack monitoring results

Parameter	Reporting units	Results	Limits	Compliant (Y/N)
Average particulate matter (PM)	mg/Nm³	74.00	50	N
Average particulate matter (PM10)	mg/Nm³		N/A	N/A
Average particulate matter (PM2.5)	mg/Nm³		N/A	N/A
Average sulphur dioxide (SO_2)	mg/Nm³	0.00	1000	Y
Average oxides of nitrogen (NOx)	mg/Nm³	93.82	50	Y
Average oxygen (in stack)	%v/v	19.5	N/A	N/A
Referenced oxygen	%	N/A	N/A	N/A

N/A: Not applicable

Source: South Deep CPR 2021

Stack ID Smelter stack parameters include:

- Gas velocity
- Gas volumetric flow rate
- Gas temperature
- Gas static and absolute pressure
- Moisture content
- Isokinetic emissions:
  - PM
  - Hydrogen halides and halogens (HCl, HF & C_{12})
  - Ammonia (NH_3)
- Anisokinetic emissions (instrumental monitoring) such as combustion gas components (O2, NO, NO2, NOx, CO, CO2 & SO2).

20.2.5 Emissions summary

Table 20.2 shows the anisokinetic emmisions testing results.

Table 20.2: Anisokinetic emissions results

Parameter	Reporting units	Results	Limits	Compliant (Y/N)
Average particulate matter (PM)	mg/Nm³	9.94	50	Y
Average particulate matter (PM10)	mg/Nm³	TBD	N/A	N/A
Average particulate matter (PM2.5)	mg/Nm³	TBD	N/A	N/A
Average sulphur dioxide (SO_2)	mg/Nm³	0	400	Y
Average oxides of nitrogen (NO_X)	mg/Nm³	0.41	300	Y
Average carbon monoxide (CO)	mg/Nm³	6.77	30	Y
Average hydrogen chloride (HCl)	mg/Nm³	BDL (<0.5)	30	Y
Average hydrogen fluoride (HF)	mg/Nm³	BDL (<0.1)	50	Y
Average chlorine (Cl_2)	mg/Nm³	BDL (<2)	100	Y
Average ammonia (NH_3)	mg/Nm³	1.33	50	Y
Average oxygen (in stack)	%v/v	20.9	N/A	N/A
Referenced oxygen	%	N/A	N/A	N/A

N/A: Not applicable
TBD: To Be Done
BDL: Below Detection Limit
Source: South Deep 2021

20.3 Permitting

The 2012 approved Environmental Management Plan (EMP) was updated and submitted to the DMRE in November 2016 for approval. As part of the EMP, a performance audit is conducted on a two-yearly basis. The last environmental performance audit was conducted in 2020 in accordance with the December 2014 NEMA regulations and submitted to the DMRE.

South Deep received its AEL in January 2017.

A BMAP was developed in 2012 and updated in 2016. Following the renewal process, an alien vegetation eradication management plan was approved in 2016. During 2021, South Deep continued implementing its BMAP.

South Deep was issued with a new WUL on the 19 November 2018 and has reviewed its water management plan to align with the new licence.

A summary of key current South Deep permits is provided in Table 20.3.

Table 20.3: List of South Deep permits

Number	Purpose	Registered holder	Status	Grade date	Expiry date	Fines
WR/16-17/AEL2/2	Atmosphere Emission Licence	Goldfields Operations Limited and GFI Joint Venture Holdings (Pty) LTD	Valid	25-Jan-17	25-Jan-22	Nil
28/1/2/1/2433	CTP & delivery schedule	Goldfields Operations Limited and GFI Joint Venture Holdings (Pty) LTD	Valid	22-Dec-20	01-Dec-24	Nil
12/12/20/1451	Integrated Environmental Authorisation	Goldfields Operations Limited and GFI Joint Venture Holdings (Pty) LTD	Valid	23-Feb-11	23-Feb-31	Nil
GP30/5/1/2/2/ (220) MR	Mining Right	Goldfields Operations Limited and GFI Joint Venture Holdings (Pty) LTD	Valid	13-Jul-10	12-Jul-40	Nil
03/C22J/ACFGIJ/1369	Water Use Licence	Goldfields Operations Limited and GFI Joint Venture Holdings (Pty) LTD	Valid	21-Nov-11	21-Nov-40	Nil

Notes:
a) The Qualified Person has selected key permits to demonstrate permitting.
b) The Qualified Person is of the opinion that the licences are in good standing and that any current or future licensing can and will be obtained for the Mineral Reserve or the Mineral Resource.
c) The Qualified Person is of the opinion that South Deep has a good standing with licensing authorities, community groups and that licensing is not expected to be material to Mineral Reserves or Mineral Resources.
d) CTP: Continuous Transport Permit

Source: South Deep CPR 2021

South Deep mine's permits are up to date and the mine received no fines or penalties during 2021 and notes no encumbrances for non-compliance or breaches.

20.4 Social and community

Regular, proactive and meaningful engagements with stakeholders remains an important element in executing the South Deep Sustainable Development Strategy. Such engagement enables South Deep to collaborate with key stakeholders on the execution of relevant strategies, identify and prioritise the interests of stakeholders, and receive valuable feedback. The Company's stakeholder engagement approach is directed through a comprehensive stakeholder engagement strategy and framework.

South Deep is a member of the Rietspruit Catchment Forum where water issues are discussed. In addition, South Deep participates in West Rand District Municipality Mining Forum where environmental issues and social and labour plan related matters are discussed. South Deep is also a member of the Far West Rand Dolomitic Water Association (as an observer). At this forum issues of land and water management as well as closure are discussed. South Deep also regularly conducts Community Open Days, environmental lectures and tours in various host communities.

South Deep has achieved most of its Social and Labour Plan (SLP) commitments except for joint ventures and the completion of the Simunye Secondary School. These two commitments were carried over into 2018-2022 as agreed with the DMRE. The Simunye Secondary School project has not commenced due to delays imposed by the Gauteng Department of Education (GDE). The GDE has requested South Deep to use the funds allocated for the school project to build classrooms in other schools in the area as the GDE has fully funded the construction of the Simunye Secondary School. Stakeholder engagements are ongoing.

The approved 2018-2022 SLP was translated into two dominant languages in the host community, distributed at key public areas including on the Company's website and is made available to community members on request. Implementation of the SLP is ongoing. The regulator audited compliance in 2020 and issued no material findings and acknowledged an improvement in all the SLP pillars compared to the 2019 audit. South Deep was encouraged to further improve host community procurement as it is becoming an issue with the communities surrounding all mining houses.

South Deep has commenced with developing a land management strategy to promote local farm enterprises using mine-owned land. This will assist in the creation of jobs in line with the West Rand regional strategy of promoting agriculture as an alternative to mining in the area.

A Partnership Agreement to replace the Gold Alliance (partnership between Sibanye and Gold Fields) and a new Memorandum of Understanding on the new partnership was finalised and signed off. This allows the two mining houses to collaborate on projects of common interest. Partnerships are in place for the construction of a Technical Vocational Education and Training (TVET) College in the area and on agricultural projects. A partnership with the local municipality and a multinational supplier resulted in installation of 100 solar powered street lights at an informal settlement close to South Deep.

The host community procurement initiative, which was launched in 2015, has shown incremental improvements since its inception and has yielded and continues to yield positive results over recent years. The participation of host community companies continues to increase in South Deep's supply chain. The 2020 target for host community procurement spend was 25 % of the total procurement spend or at least R500 million. In 2020, 24.1 % was achieved or R536 million. The focus is now on the development and support of women and youth owned and controlled companies from host communities as stated in the Mining Charter.

The 2020 Company-Community Relationship Assessment conducted by an independent certified service provider showed that the quality of relations has improved in all five assessed communities. The overall quality percentage of company-community relations and support for South Deep increased to 61 % from 32 % in 2014 which is regarded as a moderate relationship according to International Council on Metals & Mining's (ICMM's) Understanding Company Community Relationship Assessment Toolkit.

The South Deep Education Trust and the South Deep Community Trust continued to focus on improvements in monitoring of and evaluating existing projects in 2020. As a result of the Trusts' interventions, and approach of building a network of beneficiaries and projects, the Trusts' projects are beginning to make progress as far as sustainability and eventual self-funding is concerned. The creation of jobs in an economy that is not reliant on the mining industry continues to be a focus. In 2020, the combined spend on South Deep Education Trust and the South Deep Community Trust projects was R12.7 million.

20.5 Mine closure

Closure costs are reviewed every year internally to reflect actual and proposed disturbances and changes in cost inputs. The 2021 cost closure estimate of $42.0 million (Table 20.4) was prepared using the Standardised Reclamation Cost Estimator (SRCE).

Table 20.4: 2021 South Deep closure cost estimate

Cost item	Mine Zone	$ '000
Twin shaft waste rock dump	Zone A	205
Metallurgical plant	Zone B	1 278
Twin Shaft entrance / access road	Zone C	166
Twin Shaft offices / carports	Zone D	871
Twin Shaft workshops	Zone E	773
Twin Shaft shaft infrastructure	Zone F	3 619
Twin Shaft TSF	one G	3 925
South Shaft TSF / sewage works	Zone H	2 857
South Shaft training / accommodation	Zone I	860
South Shaft village	Zone J	1 144
South Shaft waste management	Zone K	389
South Shaft administration offices	Zone L	274
South Shaft and backfill plant	Zone M	2 111
South Shaft refrigeration plant	Zone N	818
South Shaft workshops	Zone O	558
South Shaft R28 access	Zone P	62
Doornpoort TSF	Zone Q	9 552
Aspects that cross multiple zones		
Roads	Roads	86
Waste management	Waste management	4 131
Water management	Water management	898
Monitoring	Monitoring	629
Planning	Planning	169
Maintenance	Maintenance	834
Solar plant	Solar plant	19
Subtotal		36 228
Allowances		
Contingency		3 623
Contract administration		2 174
Total		42 024

Source: South Deep CPR, 2022

An estimated $14.4 million has been funded to date. A further $0.8 million per annum (for a life of mine total of $50 million) is included in the techno economic model under closure costs and provisions. The total contribution exceeds the estimated required closure cost by $8 million to cater for future disturbances.

Concurrent rehabilitation entails TSF reclamation, unused buildings demolition. Fixed infrastructure such as treatment plant, buildings, and shafts will only be demolished and rehabilitated at the end of mine life.

South Deep's has an Integrated Mine Closure Plan that is fully aligned to the Gold Fields Group Guideline, South Africa's Regulatory requirements, as well as the ICMM framework. South Deep's approach to mine closure is applied to the full mining life cycle, which consists of eight phases:

- Exploration (including prior planning)
- Pre-feasibility study
- Feasibility (which includes planning and design)
- Construction
- Operation
- Decommissioning
- Closure
- Post closure (which may include relinquishment of tenure and liability).

Currently South Deep is in the operational phase. For purposes of the operational phase, the mine has developed a three year concurrent (progressive) rehabilitation plan with associated financial provisioning catering for unplanned immediate closure and normal life of mine Mineral Reserves closure, which includes provisions for post-closure costs.

As per NEMA, Financial Regulations and Group Guideline, South Deep annually reviews its closure and rehabilitation plans as well as closure cost estimates for day-of-assessment (unplanned immediate closure) and life of mine Mineral Reserves. Closure costs are estimated using the SRCE model. The mine's closure costs are fully funded using a combination of trust fund contributions and financial guarantees:

- The closure period will commence once the last planned tonne of ore has been mined. The implementation of the closure actions will be undertaken over three years. Once closure actions are complete the mine will enter a five year monitoring and maintenance post closure period, with an additional 10 years of water monitoring. The 15 year period is assumed to be sufficient to collect the necessary data to demonstrate that relinquishment criteria have been achieved.
- Water management infrastructure developed for the operational phase will be retained for closure at the end of the life of mine Mineral Reserves as necessary and will only be decommissioned if demonstrated to be redundant. However, for purposes of this assessment, SRK has assumed that all water management infrastructure will be removed either during closure or during the post closure period.
- All demolition rubble is considered General Waste as per the definition of Demolition Waste in Category B of Schedule 3 of the National Environmental Management Waste Amendment Act (NEM:WAA) and based on the classification as General can therefore be incorporated into the backfill during the closure of the declines.

20.6 Qualified Person's opinion on rehabilitation and closure cost estimates

The following is noted:

a) The Qualified Person is of the opinion that South Deep is conducting concurrent rehabilitation where appropriate.

b) The Qualified Person is of the opinion that the closure cost estimates, and duration are reasonable and practical.

21 Capital and operating costs

21.1 Capital costs

Capital costs for South Deep are based on items that will maintain operations for the 31 December 2021 Mineral Reserve life of mine plan. Major budgeted capital expenditure items in the short term (5 years) include:

- Ongoing development and infrastructure of the new mine areas on 100, 105 and 110 Levels.
- 30 MW refrigeration plant planned on 80 Level.
- Construction of the conveyor systems on 105 Level.
- Bulk air-cooling systems on 95, 100, 105 and 110 Levels.
- Development of the first workshop on 105 Level.
- 50 MW solar plant.
- Doornpoort TSF expansion.
- Major replacement of equipment.
- Major infrastructure replacements and upgrades.
- IT equipment and upgrades.

The forecast capital costs are summarised in Table 21.1.

Table 21.1: Capital costs with only 2022 year escalated (dollars)

Capital cost item	Units $	2022	2023	2024	2025	2026	202	2028	2029
Mining MP&Dev	$ million	15	19	19	19	18	21	9	14
Mining capital works	$ million	51	51	51	47	48	53	43	46
Processing (incl. TSFs)	$ million	9	6	1	1	1	1	1	1
G&A capital	$ million	39	14	27	20	13	14	14	16
Exploration	$ million	0	0	0	0	0	0	0	0
Total capex	$ million	114	88	98	86	80	88	67	77

		2030	2031	2032	2033	2034	2035	2036	2037
Mining MP&Dev	$ million	25	23	22	28	35	35	37	31
Mining capital works	$ million	43	42	44	51	47	43	61	55
Processing (incl. TSFs)	$ million	1	1	1	1	2	1	1	1
G&A capital	$ million	12	12	13	13	12	11	11	12
Exploration	$ million	0	0	0	0	0	0	0	0
Total capex	$ million	82	79	81	93	96	90	110	100

		2038	2039	2040	2041	2042	2043	2044	2045
Mining MP&Dev	$ million	40	32	24	21	14	12	12	14
Mining capital works	$ million	52	56	52	39	42	47	40	34
Processing (incl. TSFs)	$ million	1	1	1	1	1	1	1	1
G&A capital	$ million	11	13	12	13	17	11	15	12
Exploration	$ million	0	0	0	0	0	0	0	0
Total capex	$ million	104	102	89	74	73	71	67	60

		2046	2047	2048	2049	2050	2051	2052	2053
Mining MP&Dev	$ million	8	12	8	10	7	11	6	5
Mining capital works	$ million	50	45	37	41	41	35	37	50
Processing (incl. TSFs)	$ million	1	1	1	2	1	1	1	1
G&A capital	$ million	11	12	13	12	11	7	6	6
Exploration	$ million	0	0	0	0	0	0	0	0
Total capex	$ million	71	70	59	65	60	54	50	62

		2054	2055	2056	2057	2058	2059	2060	2061
Mining MP&Dev	$ million	6	6	10	11	6	6	6	6
Mining capital works	$ million	34	37	37	38	38	37	43	35
Processing (incl. TSFs)	$ million	1	1	1	1	1	1	1	1
G&A capital	$ million	6	5	5	6	6	10	7	6
Exploration	$ million	0	0	0	0	0	0	0	0
Total capex	$ million	47	48	53	56	50	54	56	48

		2062	2063	2064	2065	2066	2067	2068	2069
Mining MP&Dev	$ million	6	12	5	6	6	6	6	11
Mining capital works	$ million	37	40	35	33	37	38	36	36
Processing (incl. TSFs)	$ million	1	1	2	1	1	1	1	1
G&A capital	$ million	17	6	6	6	6	5	4	6
Exploration	$ million	0	0	0	0	0	0	0	0
Total capex	$ million	61	59	49	46	50	50	48	54

		2070	2071	2072	2073	2074	2075	2076	2077
Mining MP&Dev	$ million	6	6	6	6	6	11	6	5
Mining capital works	$ million	39	33	37	40	33	33	37	37
Processing (incl. TSFs)	$ million	1	1	1	1	1	1	1	1
G&A capital	$ million	5	7	5	4	7	5	6	5

Exploration	$ million	0	0	0	0	0	0	0	0
Total capex	$ million	51	47	49	52	47	49	49	48

		2078	2079	2080	2081	2082	2083	2084	2085
Mining MP&Dev	$ million	5	6	5	11	6	5	8	8
Mining capital works	$ million	37	36	38	33	37	39	34	33
Processing (incl. TSFs)	$ million	1	2	1	1	1	1	1	1
G&A capital	$ million	5	4	3	6	9	4	4	4
Exploration	$ million	0	0	0	0	0	0	0	0
Total capex	$ million	48	48	47	50	53	49	47	46

		2086	2087	2088	2089	2090	2091	2092	2093
Mining MP&Dev	$ million	8	13	8	8	8	8	8	8
Mining capital works	$ million	37	39	37	38	38	31	37	38
Processing (incl. TSFs)	$ million	1	1	1	1	1	1	1	1
G&A capital	$ million	4	4	5	7	5	5	3	3
Exploration	$ million	0	0	0	0	0	0	0	0
Total capex	$ million	49	57	51	54	51	45	49	50

		2094	2095	2096	2097	2098	2099	2100	2101
Mining MP&Dev	$ million	8	8	0	0	0	0	0	0
Mining capital works	$ million	34	34	0	0	0	0	0	0
Processing (incl. TSFs)	$ million	1	1	0	0	0	0	0	0
G&A capital	$ million	3	3	0	0	0	0	0	0
Exploration	$ million	0	0	0	0	0	0	0	0
Total capex	$ million	46	45	0	0	0	0	0	0

Source: South Deep CPR 2021

The life of mine at South Deep is complete in 2101. Capital expenditure ceases six years before closure of the mine.

Capital scheduling is aligned with the production profile and major construction is timed in accordance with production requirements. A 5 % capital contingency is carried from 2024 to 2095 which amounts to $213 million. The entire capital cost profile is estimated at pre-feasibility level, which is within ±25 %.

Major capital expenditures relate to mining development, infrastructure (shafts and plant) upgrades, production fleet and the ESG initiatives expenditure, which is aligned with net zero carbon by 2050.

21.2 Operating costs

Budgeted operating costs for the 31 December 2021 Mineral Reserve life of mine plan are summarised in Table 21.2.

Table 21.2: Operating costs with only 2022 year escalated (dollars)

Operating cost item	Units	2022	2023	2024	2025	2026	202	2028	2029
Mining	$ million	235	233	248	252	244	227	229	231
Processing	$ million	41	42	45	44	43	43	41	44
G&A costs	$ million	58	58	58	57	57	55	55	55
Other costs	$ million	14	14	14	14	14	14	14	14
Total operating costs	$ million	347	347	365	368	358	339	339	344

		2030	2031	2032	2033	2034	2035	2036	2037
Mining	$ million	229	209	198	225	213	191	185	179
Processing	$ million	43	43	43	44	42	41	43	42
G&A costs	$ million	54	53	53	50	50	50	50	50
Other costs	$ million	14	14	14	14	14	14	14	14
Total operating costs	$ million	340	319	307	332	319	295	292	284

		2038	2039	2040	2041	2042	2043	2044	2045
Mining	$ million	196	217	232	214	212	215	207	223
Processing	$ million	41	42	44	41	42	39	40	41
G&A costs	$ million	50	50	50	49	49	49	49	49
Other costs	$ million	14	14	14	14	14	14	14	14
Total operating costs	$ million	301	322	340	319	317	317	309	327

		2046	2047	2048	2049	2050	2051	2052	2053
Mining	$ million	211	208	208	188	218	206	192	216
Processing	$ million	41	43	44	42	42	42	43	44
G&A costs	$ million	49	49	49	49	49	49	49	47
Other costs	$ million	14	14	14	14	14	14	14	14
Total operating costs	$ million	315	314	314	293	322	310	297	320

		2054	2055	2056	2057	2058	2059	2060	2061
Mining	$ million	207	220	214	220	221	202	215	213
Processing	$ million	42	45	45	45	42	43	44	44
G&A costs	$ million	47	47	47	47	47	47	47	47
Other costs	$ million	14	14	14	14	14	14	14	14
Total operating costs	$ million	309	326	320	326	323	305	319	317

		2062	2063	2064	2065	2066	2067	2068	2069
Mining	$ million	228	222	199	203	205	214	217	220
Processing	$ million	47	42	40	39	40	42	38	43
G&A costs	$ million	47	47	47	47	47	47	47	47
Other costs	$ million	14	14	14	14	14	14	14	14
Total operating costs	$ million	336	325	299	302	305	317	316	323

		2070	2071	2072	2073	2074	2075	2076	2077
Mining	$ million	236	214	232	229	205	233	242	207
Processing	$ million	44	36	38	41	38	39	37	38
G&A costs	$ million	47	47	47	47	47	47	47	47
Other costs	$ million	14	14	14	14	14	14	14	14
Total operating costs	$ million	340	310	331	330	303	332	340	305

		2078	2079	2080	2081	2082	2083	2084	2085
Mining	$ million	232	222	228	224	232	215	229	250
Processing	$ million	38	35	37	40	37	37	39	40

G&A costs	$ million	47	47	47	47	47	47	47	47
Other costs	$ million	14	14	14	14	14	14	14	14
Total operating costs	$ million	331	317	325	325	330	312	329	351
		2086	**2087**	**2088**	**2089**	**2090**	**2091**	**2092**	**2093**
Mining	$ million	240	214	238	243	205	202	213	210
Processing	$ million	37	39	40	38	36	37	37	38
G&A costs	$ million	47	47	47	47	47	47	47	47
Other costs	$ million	14	14	14	14	14	14	14	14
Total operating costs	$ million	338	314	338	342	302	300	311	308
		2094	**2095**	**2096**	**2097**	**2098**	**2099**	**2100**	**2101**
Mining	$ million	204	196	208	217	184	200	183	145
Processing	$ million	36	37	41	43	38	43	42	37
G&A costs	$ million	47	47	47	47	47	47	47	46
Other costs	$ million	14	14	14	14	14	14	14	14
Total operating costs	$ million	300	293	309	320	282	303	286	242

Source: South Deep CPR 2021

The operating costs consider the required production profile and the likely physical changes in the operating parameters over the full period of the life of mine plan. The basis of forward projections takes into account recent historical and forecast performance, including modifications for inflation.

Mining costs include all direct mining, engineering maintenance and backfill placement activities in the mining areas. The forecast six-year average mining cost is estimated at $107/t mined and the life of mine average is $85/t mined in 2022 terms.

Processing costs also include tailings, waste disposal costs and backfill plant costs. The forecast six-year average processing cost is estimated at $18/t milled and the life of mine average is $13/t milled.

Other costs include allocated centralised costs. Allocated centralised costs are forecast at an average of $71 million per annum over the next six years and include costs for health and safety, occupational environment and hygiene, mine technical services, environmental management, human resources, finance and other centralised costs.

The following are applicable for closure costs:

- The day of assessment closure cost as at 31 December 2021 is $42 million
- The expected end of life closure cost is $50 million
- The closure costs are catered for in the form of a contribution to a trust fund and secured by means of guarantees.

All post closure cost together with rehabilitation costs are legislated to be catered for in the form of a contribution equal to required closure cost estimate. This is performed by an accredited external party and is currently costed at $42 million and includes post closure figures. Additional rehabilitation contributions for future disturbances amount to $8 million over the life of mine. The closure cost is estimated at feasibility level accuracy.

22 Economic analysis

22.1 Key inputs and assumptions

The economic analysis of South Deep is based on the 31 December 2021 Mineral Reserve life of mine plan to 2101, incorporating the production profiles from the various mining areas, associated revenue streams from gold sales, and budgeted operating and capital costs.

The current mine production ramp-up is achieved through a combination of an increasing mining footprint (increase in number of available faces/stopes) and an increasing contribution from LHS in NoW, while development and de-stress mining increases and then remains reasonably constant (Table 22.1). The production tonnes build-up over the next three years from the current 9.3 tonnes gold annual output will increase to circa 12 tonnes gold annual production.

Table 22.1: South Deep contributions by mining type

Grade	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Development (kt)	30	40	42	23	26	8	18	20	21	15	22
De-stress (kt/month)	32	31	38	30	32	34	32	23	23	22	26
Long-hole stoping (kt/month)	79	90	100	124	124	135	141	136	134	149	155
Production rigs	19	21	23	20	21	18	20	19	19	19	19

Source: South Deep CPR, 2021

The physical inputs for the Mineral Reserve life of mine plan are summarised in Table 22.2.

Table 22.2: Life of mine techno-economic metrics for the Mineral Reserve

Sources	Units	2022	2023	2024	2025	2026	2027	2028	2029
Life of mine processed	koz	333	364	396	411	399	403	403	414
Plant recovery	%	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %
Sold	koz	322	351	382	397	385	389	389	400
Costs, revenue and cash flow									
Revenue	$ million	423	462	502	521	506	511	511	525
Operating costs	$ million	347	347	365	368	358	339	339	344
Capital costs	$ million	114	88	98	86	80	88	67	77
Other Costs	$ million	9	20	15	16	15	11	13	14
Royalties	$ million	2	2	3	3	3	3	3	3
Government levies	$ million	0	0	0	0	0	0	0	0
Interest (if applicable)	$ million	0	0	0	0	0	0	0	0
Total costs (excluding tax)	$ million	473	458	481	472	455	441	422	437
Taxes	$ million	0	0	0	0	0	0	0	0
Cash flow	$ million	-49	4	21	49	50	70	89	87
Disc. cash flow at 9.4% (NPV)	$ million	-45	3	16	34	32	41	47	43

		2030	2031	2032	2033	2034	2035	2036	2037
Life of mine processed	koz	403	402	402	408	409	405	403	403
Plant recovery	%	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %
Sold	koz	388	387	388	394	395	391	389	389
Costs, revenue and cash flow									
Revenue	$ million	510	509	510	517	519	513	511	511
Operating costs	$ million	340	319	307	332	319	295	292	284
Capital costs	$ million	82	79	81	93	96	90	110	100
Other	$ million	10	12	12	9	9	13	9	12
Royalties	$ million	5	7	7	6	10	13	11	13
Government levies	$ million	0	0	0	0	0	0	0	0
Interest (if applicable)	$ million	0	0	0	0	0	0	0	0

Total costs (excluding tax)	$ million	437	416	408	440	433	410	422	408
Taxes	$ million	0	0	0	0	0	15	21	30
Cash flow	$ million	73	93	102	77	86	88	68	73
Disc. cash flow at 9.4% (NPV)	$ million	33	38	38	26	27	25	18	17

		2038	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
Life of mine processed	koz	403	402	404	403	403	404	404	403
Plant recovery	%	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %
Sold	koz	389	388	390	389	389	390	390	389
Costs, revenue and cash flow									
Revenue	$ million	510	510	512	510	511	512	512	511
Operating costs	$ million	301	322	340	319	317	317	309	327
Capital costs	$ million	104	102	89	74	73	71	67	60
Other	$ million	10	10	13	13	12	8	13	12
Royalties	$ million	11	9	9	12	12	13	13	12
Government levies	$ million	0	0	0	0	0	0	0	0
Interest (if applicable)	$ million	0	0	0	0	0	0	0	0
Total costs (excluding tax)	$ million	426	444	451	418	414	409	403	411
Taxes	$ million	24	17	16	27	28	29	33	29
Cash flow	$ million	61	49	44	65	69	74	76	71
Disc. cash flow at 9.4% (NPV)	$ million	13	10	8	11	10	10	10	8

		2046	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**	**2053**
Life of mine processed	koz	404	403	405	403	403	404	397	402
Plant recovery	%	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %
Sold	koz	390	389	390	389	389	390	383	388
Costs, revenue and cash flow									
Revenue	$ million	512	511	513	511	510	512	503	510
Operating costs	$ million	315	314	314	293	322	310	297	320
Capital costs	$ million	71	70	59	65	60	54	50	62
Other	$ million	9	14	13	8	12	11	12	10
Royalties	$ million	13	13	14	15	13	14	15	13
Government levies	$ million	0	0	0	0	0	0	0	0
Interest (if applicable)	$ million	0	0	0	0	0	0	0	0
Total costs (excluding tax)	$ million	407	411	400	381	408	390	374	405
Taxes	$ million	30	30	34	38	30	37	39	30
Cash flow	$ million	75	70	79	92	72	86	89	74
Disc. cash flow at 9.4% (NPV)	$ million	8	7	7	7	5	6	6	4

		2054	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**
Life of mine processed	koz	405	407	412	404	404	405	404	405
Plant recovery	%	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %
Sold	koz	391	393	397	390	390	391	390	391
Costs, revenue and cash flow									
Revenue	$ million	514	515	522	512	512	514	511	513
Operating costs	$ million	309	326	320	326	323	305	319	317
Capital costs	$ million	47	48	53	56	50	54	56	48
Other	$ million	11	12	11	9	9	12	10	12
Royalties	$ million	15	14	15	13	14	15	13	14
Government levies	$ million	0	0	0	0	0	0	0	0
Interest (if applicable)	$ million	0	0	0	0	0	0	0	0
Total costs (excluding tax)	$ million	383	400	398	404	396	386	398	391
Taxes	$ million	40	35	37	31	34	39	33	37
Cash flow	$ million	91	81	87	76	82	89	80	85
Disc. cash flow at 9.4% (NPV)	$ million	5	4	4	3	3	3	2	2

	2062	**2063**	**2064**	**2065**	**2066**	**2067**	**2068**	**2069**

Life of mine processed	koz	404	408	408	411	409	411	409	410
Plant recovery	%	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %
Sold	koz	390	394	394	396	395	396	394	396
Costs, revenue and cash flow									
Revenue	$ million	512	517	518	520	518	520	518	520
Operating costs	$ million	336	325	299	302	305	317	316	323
Capital costs	$ million	61	59	49	46	50	50	48	54
Other	$ million	12	7	11	12	10	12	9	12
Royalties	$ million	12	13	16	16	16	15	15	14
Government levies	$ million	0	0	0	0	0	0	0	0
Interest (if applicable)	$ million	0	0	0	0	0	0	0	0
Total costs (excluding tax)	$ million	421	404	375	376	380	393	388	403
Taxes	$ million	26	32	43	44	42	38	38	35
Cash flow	$ million	65	81	99	100	97	89	92	81
Disc. cash flow at 9.4% (NPV)	$ million	2	2	2	2	2	1	1	1

		2070	**2071**	**2072**	**2073**	**2074**	**2075**	**2076**	**2077**
Life of mine processed	koz	408	409	408	407	408	408	411	409
Plant recovery	%	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %
Sold	koz	393	395	394	393	394	394	396	395
Costs, revenue and cash flow									
Revenue	$ million	516	514	512	511	512	512	515	514
Operating costs	$ million	340	310	331	330	303	332	340	305
Capital costs	$ million	51	47	49	52	47	49	49	48
Other	$ million	11	8	11	12	9	9	9	12
Royalties	$ million	13	15	13	13	15	13	13	15
Government levies	$ million	0	0	0	0	0	0	0	0
Interest (if applicable)	$ million	0	0	0	0	0	0	0	0
Total costs (excluding tax)	$ million	414	380	403	408	375	404	411	380
Taxes	$ million	30	39	32	31	41	31	30	41
Cash flow	$ million	72	94	77	73	96	77	75	93
Disc. cash flow at 9.4% (NPV)	$ million	1	1	1	1	1	1	1	1

		2078	**2079**	**2080**	**2081**	**2082**	**2083**	**2084**	**2085**
Life of mine processed	koz	410	407	410	409	411	407	408	401
Plant recovery	%	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %
Sold	koz	396	393	396	395	396	393	393	387
Costs, revenue and cash flow									
Revenue	$ million	515	511	515	513	515	510	511	503
Operating costs	$ million	331	317	325	325	330	312	329	351
Capital costs	$ million	48	48	47	50	53	49	47	46
Other	$ million	10	9	11	11	7	11	12	10
Royalties	$ million	13	14	14	14	13	14	13	11
Government levies	$ million	0	0	0	0	0	0	0	0
Interest (if applicable)	$ million	0	0	0	0	0	0	0	0
Total costs (excluding tax)	$ million	402	388	397	400	403	387	401	417
Taxes	$ million	33	36	35	34	32	37	33	24
Cash flow	$ million	80	86	83	80	80	86	77	62
Disc. cash flow at 9.4% (NPV)	$ million	0	0	0	0	0	0	0	0

		2086	**2087**	**2088**	**2089**	**2090**	**2091**	**2092**	**2093**
Life of mine processed	koz	407	409	409	408	409	410	407	409
Plant recovery	%	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %
Sold	koz	393	395	395	394	395	395	393	394
Costs, revenue and cash flow									
Revenue	$ million	510	513	514	512	513	514	511	513
Operating costs	$ million	338	314	338	342	302	300	311	308

Capital costs	$ million	49	57	51	54	51	45	49	50
Other	$ million	7	10	10	7	11	11	8	9
Royalties	$ million	12	14	13	12	15	16	15	15
Government levies	$ million	0	0	0	0	0	0	0	0
Interest (if applicable)	$ million	0	0	0	0	0	0	0	0
Total costs (excluding tax)	$ million	407	395	412	414	380	371	382	382
Taxes	$ million	29	35	29	27	40	43	38	39
Cash flow	$ million	74	83	72	71	93	99	91	92
Disc. cash flow at 9.4% (NPV)	$ million	0	0	0	0	0	0	0	0

		2094	**2095**	**2096**	**2097**	**2098**	**2099**	**2100**	**2101**
Life of mine processed	koz	409	404	409	409	408	408	348	270
Plant recovery	%	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %	96.50 %
Sold	koz	395	390	395	394	394	394	336	261
Costs, revenue and cash flow									
Revenue	$ million	513	507	513	513	512	512	437	339
Operating costs	$ million	300	293	309	320	282	303	286	242
Capital costs	$ million	46	45	0	0	0	0	0	0
Other	$ million	9	10	19	11	12	12	9	-20
Royalties	$ million	16	16	19	18	21	19	14	9
Government levies	$ million	0	0	0	0	0	0	0	0
Interest (if applicable)	$ million	0	0	0	0	0	0	0	0
Total costs (excluding tax)	$ million	372	365	347	349	315	335	309	231
Taxes	$ million	42	43	54	51	62	56	39	24
Cash flow	$ million	99	99	112	113	134	122	89	84
Disc. cash flow at 9.4% (NPV)	$ million	0	0	0	0	0	0	0	0

Note: Disc. – discounted; NPV – Net present value.

a) Mineral Resources are exclusive of Mineral Reserves.

b) Rounding of figures may result in minor computational discrepancies.

The BEE shareholders will be entitled to a cumulative preferential dividend which is calculated according to a pre-determined time-based schedule; this schedule is based on an attributable life of mine gold production re-calculated on an annual basis. This arrangement will cease in 20 years' time from inception. The economic ownership of the property therefore changes nominally on an annual basis.

Source: South Deep CPR 2021

Table 22.3: Gold Fields attributable gold, cash flow and NPV

Sources	**Units**	**2022** 96.43 %	**2023** 96.43 %	**2024** 96.43 %	**2025** 96.43 %	**2026** 93.10 %	**2027** 93.10 %	**2028** 93.10 %	**2029** 93.10 %
% Attributable gold	koz	310	339	368	383	359	363	362	372
% Cash flow	$ million	-48	4	20	47	47	65	83	81

		2030 93.10 %	**2031** 90 %	**2032** 90 %	**2033** 90 %	**2034** 90 %	**2035** 90 %	**2036** 90 %	**2037** 90 %
% Attributable gold	koz	362	351	351	356	357	354	352	352
% Cash flow	$ million	68	84	92	69	78	80	62	66

		2038	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
90 % Attributable gold	koz	350	349	351	350	350	351	351	350
90 % Cash flow	$ million	55	44	40	59	62	67	68	64

		2046	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**	**2053**
90 % Attributable gold	koz	351	350	351	350	350	351	345	349
90 % Cash flow	$ million	67	63	71	82	65	77	80	67

		2054	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**
90 % Attributable gold	koz	352	353	358	351	351	352	351	352

90 % Cash flow	$ million	82	73	78	69	74	80	72	76
		2062	**2063**	**2064**	**2065**	**2066**	**2067**	**2068**	**2069**
90 % Attributable gold	koz	351	355	355	357	355	357	355	356
90 % Cash flow	$ million	59	73	89	90	87	80	82	73
		2070	**2071**	**2072**	**2073**	**2074**	**2075**	**2076**	**2077**
90 % Attributable gold	koz	354	356	354	354	354	354	357	356
90 % Cash flow	$ million	65	85	69	66	86	69	67	84
		2078	**2079**	**2080**	**2081**	**2082**	**2083**	**2084**	**2085**
90 % Attributable gold	koz	356	354	356	355	357	353	354	348
90 % Cash flow	$ million	72	78	75	72	72	78	70	56
		2086	**2087**	**2088**	**2089**	**2090**	**2091**	**2092**	**2093**
90 % Attributable gold	koz	353	355	356	354	355	356	354	355
90 % Cash flow	$ million	67	75	65	64	84	89	82	83
		2094	**2095**	**2096**	**2097**	**2098**	**2099**	**2100**	**2101**
90 % Attributable gold	koz	355	351	355	355	355	355	302	235
90 % Cash flow	$ million	89	89	101	102	121	110	80	75

Disc. cash flow at 9.4 % (NPV)	$ million	515

Note: Disc. – discounted

a) Mineral Resources are exclusive of Mineral Reserves.

b) Rounding of figures may result in minor computational discrepancies.

Source: South Deep CPR 2021

Table 22.4: Breakdown of ESG expenditure included in Table 21.1, Table 21.2 and Table 22.1

Sources	**Units**	**2022**	**2023**	**2024**	**2025**	**2026**	**202**	**2028**	**2029**
Progressive closure*	$ million	1	1	0	0	0	0	0	0
Decarbonisation*	$ million	26	0	13	11	5	5	5	5
		2030	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**
Progressive closure*	$ million	0	0	0	0	0	0	0	0
Decarbonisation*	$ million	5	4	4	4	4	4	4	4
		2038	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
Progressive closure*	$ million	0	0	0	0	0	0	0	0
Decarbonisation*	$ million	4	4	4	4	9	4	4	4
		2046	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**	**2053**
Progressive closure*	$ million	0	0	0	0	0	0	0	0
Decarbonisation*	$ million	4	4	4	4	4	0	0	0
		2054	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**
Progressive closure*	$ million	0	0	0	0	0	0	0	0
Decarbonisation*	$ million	0	0	0	0	0	0	0	0
		2062	**2063**	**2064**	**2065**	**2066**	**2067**	**2068**	**2069**
Progressive closure*	$ million	0	0	0	0	0	0	0	0
Decarbonisation*	$ million	13	0	0	0	0	0	0	0
		2070	**2071**	**2072**	**2073**	**2074**	**2075**	**2076**	**2077**

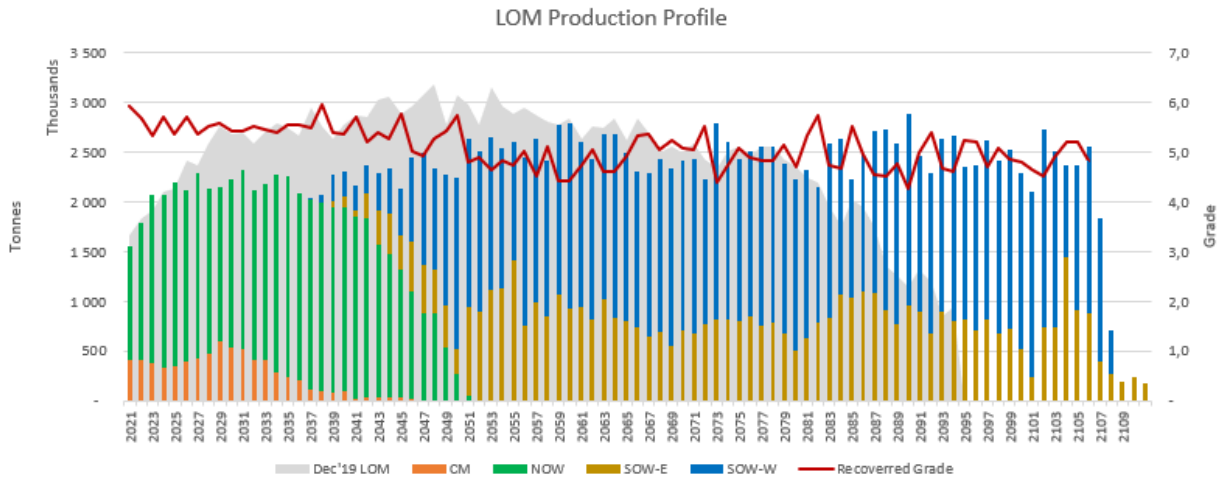
Progressive closure*	$ million	0	0	0	0	0	0	0	0
Decarbonisation*	$ million	0	0	0	0	0	0	0	0
		2078	**2079**	**2080**	**2081**	**2082**	**2083**	**2084**	**2085**
Progressive closure*	$ million	0	0	0	0	0	0	0	0
Decarbonisation*	$ million	0	0	0	0	5	0	0	0
		2086	**2087**	**2088**	**2089**	**2090**	**2091**	**2092**	**2093**
Progressive closure*	$ million	0	0	0	0	0	0	0	0
Decarbonisation*	$ million	0	0	0	0	0	0	0	0
		2094	**2095**	**2096**	**2097**	**2098**	**2099**	**2100**	**2101**
Progressive closure*	$ million	0	0	0	0	0	0	0	0
Decarbonisation*	$ million	0	0	0	0	0	0	0	0

Source: South Deep CPR 2021

Note: Progressive closure refers to concurrent rehabilitation that is forecasted for the year. Other closure costs are included in Life of mine closure provision. Decarbonization includes the current 50MW PV Solar Plant and expansion to get to net zero by 2050.

The life of mine production profile by mine area is shown in Figure 22.1. Production from SoW is planned to commence in 2028.

Figure 22.1: South Deep life of mine production profile by area



Source: South Deep CPR, 2021

The economic assumptions on which the economic analysis is based include:

- The Mineral Reserve gold price of $1,300/oz (R650,000/kg).
- A state royalty rate of 0.5 % until the mine is in a taxable position, thereafter could increase to a maximum of 12.5 % of gross revenue.
- A corporate tax rate of 28 %.
- Tax is determined by the South African Revenue Services and caters for any assessed losses and unredeemed capital expenditure to be offset against future taxes payable.
- A base case discount rate of 9.4 % as determined by Gold Fields Corporate Finance on an annual basis.
- The discounted cash flow (DCF) being applied to annual post-tax, pre-finance cash flows reported in financial years ending December.

22.2 Economic analysis

The post-tax, pre-finance NPV for South Deep based on the annual DCF forecast using the scheduled Mineral Reserves for the life of mine is $572 million.

22.3 Sensitivity analysis

Sensitivity analyses were performed to ascertain the impact on NPV to changes in operating and capital costs, discount rate and gold price as summarised in the Table 22.5 to Table 22.9 below. This provides an indication of the economic effect that material changes may have due to the highly unpredictable operating climate. The spread of these sensitivity ranges provides some assurance as to the continued economic extractability of the project.

Table 22.5: NPV sensitivity to changes in gold price (for attributable Mineral Reserves)

Gold price	**-15 %**	**-10 %**	**-5 %**	**0 %**	**+5 %**	**+10 %**	**+15 %**	**+25 %**	**+31 %**
Gold price	**1,105**	**1,170**	**1,235**	**1,300**	**1,365**	**1,430**	**1,495**	**1,625**	**1,700**
NPV ($ million)	- 203	36	276	515	754	994	1,233	1,712	1,999

Source: CPR 2021

Table 22.6: NPV sensitivity to changes in grade (for attributable Mineral Reserves)

Grade	**-15 %**	**-10 %**	**-5 %**	**0 %**	**+5 %**	**+10 %**	**+15 %**
NPV ($ million)	-203	36	276	515	754	994	1,233

Source: CPR 2021

Table 22.7: NPV sensitivity to changes in capital costs (for attributable Mineral Reserves)

Capital costs	**-15 %**	**-10 %**	**-5 %**	**0 %**	**+5 %**	**+10 %**	**+15 %**
NPV ($ million)	637	596	556	515	474	434	393

Source: CPR 2021

Table 22.8: NPV sensitivity to changes in operating costs (for attributable Mineral Reserves)

Operating costs	**-15 %**	**-10 %**	**-5 %**	**0 %**	**+5 %**	**+10 %**	**+15 %**
NPV ($ million)	1,012	847	681	515	349	184	18

Source: CPR 2021

Table 22.9: NPV sensitivity to changes in discount rate (for attributable Mineral Reserves)

Discount rate	**4 %**	**6 %**	**8 %**	**9.4 %**	**10 %**	**12 %**
NPV ($ million)	1,440	915	638	515	473	365

Source: CPR 2021

The achievability of life of mine Mineral Reserve plans, budgets and forecasts cannot be assured as they are based on economic assumptions, many of which are beyond the control of the mine. Future cash flows and profits derived from such forecasts are inherently uncertain and actual results may be significantly more or less favourable. It is for this reason that South Deep Gold Mine presents sensitivities for operating costs and capital expenditure from -15 % to +15 %.

The most optimistic analysis in terms of revenue, which assumes prices have been underestimated by 31 %, yields an NPV of $1,712 billion. Conversely, the most pessimistic analysis in terms of revenue, which assumes prices have been overestimated by 15 %, yields an NPV of $-203 million. A similar outcome is achieved on the sensitivity relating to grade, as they both impact revenue directly.

The most optimistic analysis in terms of operating cost, which assumes input costs have been overestimated by 15 %, yields an NPV of $1,012 bn. Conversely, the most pessimistic analysis in terms of operating cost, which assumes input costs have been underestimated by 15 %, yields an NPV of $18 million.

The most optimistic analysis in terms of capital cost, which assumes input costs have been overestimated by 15 % yields an NPV of $637 million. Conversely, the most pessimistic analysis in terms of operating cost, which assumes input costs have been underestimated by 15 %, yields an NPV of $393 million.

The sensitivities indicate that South Deep is most sensitive to gold price

The Qualified Person is of the opinion that the sensitivity analysis reflects reasonable and realistic ranges, which are within historical fluctuations.

23 Adjacent properties

South Deep is situated next to the Kloof Gold Mine (east of South Deep), and south of the Ezulwini (Cooke 4) and Cooke 3, 2 and 1 (Rand Uranium), all are subsidiaries of Sibanye. South Deep is essentially stand alone and has no or little reliance of neighbouring properties and the proximity of any legal workings are not expected to interact in any way with the South Deep.

24 Other relevant data and information

Gold Fields' commitment to materiality, transparency and competency in its Mineral Resources and Mineral Reserves disclosure to regulators and in the public domain is of paramount importance to the Qualified Person. The Issuer's Executive Committee and Board of Directors continue to endorse the Company's internal and external review and audit assurance protocols. This Technical Report should be read in totality to gain a full understanding of South Deep's Mineral Resource and Mineral Reserve estimation and reporting process, including data integrity, estimation methodologies, Modifying Factors, mining and processing capacity and capability, confidence in the estimates, economic analysis, risk and uncertainty and overall projected property value.

However, to ensure consolidated coverage of the Company's primary internal controls in generating Mineral Resource and Mineral Reserve estimates the following key point summary is provided:

- A comprehensive quality assurance and quality control (QAQC) protocol is embedded at South Deep and all Gold Fields operations. It draws on industry leading practice for data acquisition and utilises national standards authority accredited laboratories which are regularly reviewed. Analytical QAQC is maintained and monitored through the submission of sample blanks, certified reference material and duplicates and umpire laboratory checks.
- Corporate Technical Services (CTS), based in Perth, comprises subject matter experts across the disciplines of geology, resource estimation, geotechnical, mining, engineering, modernisation, capital projects, processing, metallurgy, tailings management and Mineral Resource and Mineral Reserve reporting governance. The CTS team budget for regular site visits to all operating mines when emphasis is placed on-site inspection and direct engagement with the technical staff to drive protocols and standards and enable on-site training and upskilling. CTS provides technical oversight and guidance to the operating Regions and mines and ensures an additional level of assurance to the Mineral Resource and Mineral Reserve estimates to supplement the mine sites and Regional technical teams.
- Independent audit review of fixed infrastructure is conducted annually with the appointed insurance auditor focussed on plant, machinery and mine infrastructure risks. An effective structural and corrosion maintenance program with benchmark inspections is in place supported by equipment condition monitoring major critical component spares. Focus areas include the primary jaw crusher, ball mill shell or motor failure, structural failure of plant or conveyor, process tank failure and large transformer failure. Critical spares are well resourced and there are no large items not supported by on-site spares holdings.
- Mobile equipment is largely owned and well maintained by South Deep.
- Processing controls include the preparation of quarterly plant metal accounting reconciliation reports by the mine sites which are reviewed by the Regional Metallurgical Manager and VP Metallurgy in the CTS team. Any monthly reconciliation variance outside the limits provided within the Gold Fields Plant Metal Accounting Standard is flagged for follow up assessment and remediation if warranted.
- South Deep has a tailings management plan that promotes risk minimisation to operators and stakeholders over the lifecycle of each TSF. South Deep's TSFs are operated in accordance with the company TSF Management Guidelines which are aligned with the International Council on Metals & Mining's (ICMM) Position Statement on preventing catastrophic failure of TSFs (December 2016). Active TSFs are subject to an independent, external audit every three years, and regular inspections and formal dam safety reviews by formally appointed Engineers of Record (EoR). Further improvements in tailings management are expected to achieve conformance with the new International Council on Mining and Metals developed Global Industry Standard for Tailings Management (GISTM) issued in 2020.

- The integration of environmental, social and governance (ESG) themes into the estimation process continues as an important consideration for Modifying Factors, reasonable prospects for economic extraction (RPEE) assessments and to underpin the integrity of the Mineral Resources and Mineral Reserves. The Company's ESG Charter, issues and priorities are fully considered in the life of mine plan with particular emphasis on tailings management, integrated mine closure planning, security of energy and water and the social and regulatory licence to operate.
- Gold Fields also follows an embedded process of third-party reviews to provide expert independent assurance regarding Mineral Resource and Mineral Reserve estimates and compliance with relevant reporting rules and codes. In line with Gold Fields policy, every material property is reviewed by an independent third-party on average no less than once every three years, or when triggered by a material year-on-year change. Certificates of compliance are received from the companies that conduct the external audits which are also configured to drive continuous improvement in the estimation process.
- Importantly, Gold Fields endorses a well embedded risk and control matrix (RACM) configured to provide an annual assessment of the effectiveness of the Issuer's internal controls concerning the life of mine planning process and Mineral Resource and Mineral Reserve estimation and reporting.
- The internal controls include coverage of the following (inter alia):
    - Reasonableness of parameters and assumptions used in the Mineral Resource and Mineral Reserve estimation process
    - Reasonableness of the interpretations applied to the geological model and estimation techniques
    - Integrity in the mine design and scheduling, including reasonableness of the mine planning assumptions, Modifying Factors, cut-off grades, mining and processing methods and supporting key technical inputs such as year-on-year reconciliation, geotechnical, mining equipment, infrastructure, water, energy and economic analysis
    - Provision of the necessary skills, experience and expertise at the mine sites and the Regions to undertake and complete the work with the required level of technical ability and competency, including professional registration as a Qualified Person
    - Alignment with the National Instrument 43-101 Standards of Disclosure for Mineral Projects for the reporting of Mineral Resources and Mineral Reserves
    - Review of the disclosure of the Issuer's Mineral Resources and Mineral Reserves process.
- Internal controls may not prevent or detect all errors or misstatements because of its inherent limitations. Also, projections of any evaluation of effectiveness to future periods are subject to risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with policies and procedures may deteriorate.

RCubed® is a proprietary cloud-based reporting system adopted by Gold Fields in 2021 to enhance the level governance and data security concerning Mineral Resource and Mineral Reserve reporting across all Company properties. It ensures transparency and auditability for all data verification checks, information stage gating, the approvals process and confirmation of Qualified Person credentials. The RCubed® reporting system is being incorporated into the risk and control matrix RACM to support the December 2021 Mineral Resource and Mineral Reserve reporting.

25 Interpretation and conclusions

The views expressed in this Technical Report are based on the fundamental assumption that the required management resources and management skills are in place to achieve the life of mine plan projections for South Deep.

South Deep has a long production history with multiple deep-level mining methods applied. The current mining method evolved through several development cycles. It is expected that the improvements achieved to date will be used to drive continuous learning and further optimisation. The methods applied; however, have not yet been sufficiently proven at South Deep or elsewhere in the industry, which will continue to present a risk.

The Mineral Reserve estimates contained in this report should not be interpreted as assurances of the economic life or the future profitability of South Deep. Mineral Reserves are only estimates based on the factors and assumptions described herein, thus future Mineral Reserve estimates may need to be revised. For example, if production costs increase or product prices decrease, a portion of the current Mineral Resources from which the Mineral Reserves are derived, may become uneconomic and would therefore result in a lower estimate of Mineral Reserves. The life of mine plans include forward-looking technical and economic parameters and involve a number of risks and uncertainties that could cause actual results to differ materially.

The life of mine plan for South Deep has been reviewed in detail for appropriateness, reasonableness and viability, including the existence of and justification for departure from historical performance. The Qualified Person considers that the Techno-Economic Plan and associated Financial Model are based on sound reasoning, engineering judgement and a technically achievable mine plan within the context of the risk associated with the gold mining industry.

25.1 Risks and mitigating actions

The business of gold mining by its nature involves significant risks and hazards, including environmental hazards and industrial accidents. Listed below are general hazards associated with South Deep mining operations:

- Safety remains a core value for South Deep and underpins everything the Company does. The Safety Management System (ISO 45001) is embedded to ensure material unwanted events that could result in injuries and loss of life are prevented.
- Seismicity and related geotechnical implications remain a challenge given mining depth. Controls are in place to manage related risk while recent enhancements in mining layout and revised support systems showing significant improvements with fewer and less severe events.
- Failure to achieve the planned incremental efficiency improvements could put planned production ramp-up and steady state target at risk. Productivity intervention and business improvement themes, together with the implementation of the modernisation strategy are in place to ensure the life of mine Mineral Reserves plan is achieved.
- Unidentified complex geological structures may result in short term underachievement on gold production in a short term, which may also necessitate change in stope designs. This risk is accounted for by applying geological and geotechnical loss factors where appropriate in the life of mine Mineral Reserves plan. Furthermore, resource and mine definition drilling approach is in place and aimed at mitigating this risk with regular compliance reviews.
- Regional hydrology in relation to Ezulwini mine closure remains a key risk, which is closely monitored with mitigation plans in place supported by continuous engagement with relevant stakeholders. Failure along the Ezulwini (Cooke 4) boundary pillar or plugs would result in the flooding of the South Deep operation with significant safety and commercial impacts.

  The neighbouring Sibanye mine has discontinued underground mining operations at Ezulwini (Cooke 4) and is in the process of discontinuing underground mining operations at Cooke 1, 2 and 3 shafts. As part of its closure plans, Sibanye plans to allow these operations to re-water (flood). Re-watering may result in the initiation of fluid-induced seismicity and increase the risk of failure along the boundary pillar or the hydrological plugs between

Ezulwini and South Deep. The DMRE refused the environmental authorisation for partial closure and cessation of de-watering at Ezulwini, compelling Sibanye to continue de-watering. This matter is still subject to legal processes, although the most recent judgment (15 January 2021) compels Sibanye to continue pumping and treat extraneous water from the underground workings until the Minister issues a closure certificate in terms of Section 43 of the MPRDA. South Deep is actively participating in the legal and regulatory process as well as technical studies with respect to the impact of re-watering.

South Deep has implemented controls to monitor water levels and flows, including live camera and water level monitoring in the control room as well as an emergency preparation and response plan. Access ways to the plugs are maintained for inspection of the dry side of the plugs on 50 and 58 levels.

- Actions by labour groups or other interested parties who object to perceived conditions at the mine or to the perceived environmental impact of the mine. These actions may delay or halt production or may create negative publicity related to South Deep.

Table 25.1 summarises the key identified risks and the plans in place to mitigate these risks.

Table 25.1: South Deep risks and mitigating actions

Risk classification	Examples of risk type	Risk mitigation	Ounces at risk per type
High	Seismicity Power – security and cost Operational underperformance and/or cost inflation Wrench Fault and South of Wrench (SoW) uncertainty Need for increase in stability pillars Regional hydrology	1 Medium- and long-term seismicity mitigation strategy – limited de-stress progress in plan 2 Pursue solar power generation and increase generation capability 3 Productivity intervention and 6 Business Improvement (BI) themes together with Innovation and Technology implementation 4 Wrench Fault and SoW drilling program and optimisation study 5 Geotechnical loss factor 6 Ezulwini plan	12 %
Medium	1 Skills availability and retention 2 Mining competency. Ability to extract stopes efficiently; this may trigger further recovery loss factor increases 3 Unexpected geological structures 4 Aging Infrastructure, replacement and reposition to Twins, long term access stability 5 Transition from North of Wrench to SoW scheduling 6 Mining licence and legislation	1 Purposeful Visible Felt Leadership PVFL), Reinvigorating our leadership system, Long Term Incentive Plan (LTIP)and ‘mine of the future’ initiatives 2 Siyaphambili program and production engineering 3 Risk directed drilling strategy 4 Maintenance programs and transitioning to modernised rock handling systems (crushers, belts and silos) 5 Early development and further exploration 6 Mining Charter compliance	24 %
Low	1 Backfill performance and ability to tight fill 2 Access stability and backlog support demand	1 Backfill program 2 Secondary support program	64 %

Source: South Deep CPR, 2021

26 Recommendations

The South Deep Mineral Reserves currently support an 80-year life of mine plan to 2101 that values the operation at $577 million at the Mineral Reserve gold price of $1,300/oz.

The Mineral Reserve estimate includes all activities and cost related to achieve the build-up plan to 12 t Au steady state.

The South Deep Mineral Resource and Mineral Reserve as at 31 December 2021 are reasonable estimates. The Qualified Person is of the opinion that there are no additional phases of work required to enhance this disclosure.

However, the ongoing long-inclined borehole (LIB) drilling program (Item 1.3) focused on the SoW area to further enhance orebody confidence is supported.

27 References

The primary reference documents that have written consent to be used by the appointed Gold Fields Lead Qualified Persons for this Technical Report are:

The South Deep Competent Person Report 31 December 2021 for Mineral Resources and Mineral Reserves. This report has written consent from Siyanda Dludla who is the Gold Fields appointed Lead Competent Person or Qualified Person for South Deep Gold Mine. Siyanda Dludla has accepted responsibility for the Competent Person Report 31 December 2021 for Mineral Resources and Mineral Reserves as a whole.

The South Deep Competent Person Report 31 December 2021 for Mineral Resources and Mineral Reserves is referred to in this document as “South Deep CPR 2021”.

28 Glossary of technical terms and abbreviations

$	United States dollars unless otherwise stated
°C	Degrees Celsius
µm	micron or micrometre
2D, 3D	two-dimensional, three-dimensional
%	percent
AAS	Atomic absorption spectroscopy analytical technique
AC	Air core drilling technique
Ag	Silver
Ai	Abrasion index laboratory test
All-in costs or **AIC**	A non-IFRS measure which means all-in sustaining costs plus additional costs relating to growth, including non-sustaining capital expenditure and exploration, evaluation and feasibility costs not associated with current operations.
All-in sustaining costs or **AISC**	A non-IFRS measure which means operating costs excluding amortisation and depreciation, plus all costs not included therein relating to sustaining current production including sustaining capital expenditure.
ANCOLD	Australian National Committee on Large Dams
As	Arsenic
ASL	Above sea level
Au	Gold
bcm	bank cubic metres
Brownfield	Exploration conducted in areas where mineral deposits have already previously been discovered and is also termed near mine or extensional exploration.
BWi	Bond ball mill work index laboratory test
Capex	Capital expenditure
CCD	Counter-current decantation
Cu	Copper
Cut-off grade	The lowest grade of mineralised rock which determines whether it is economic to recover its precious or base metal content by further concentration.
CIL, CIP	Carbon-in-leach, carbon-in-pulp
CIM	The Canadian Institute of Mining, Metallurgy and Petroleum
CN	Cyanide
CPR	Competent Person's Report
CRM	Certified reference material
CTS	Gold Fields Corporate Technical Services team
CO, CO_2	Carbon monoxide, carbon dioxide
dB	Decibel(s)
DCF	Discounted cash flow
De-stress	By mining a two-metre slice through the orebody package an optimal position is achieved to ensure a destressed window of 50 to 60 m above or below the associates stope to provide the necessary safe geotechnical stress conditions for extraction.
DD	Diamond core drilling technique

Dilution	Low or zero grade (waste) material that is mined during the course of mining operations and forms part of the reserve.
Dissolution	The process whereby a metal is dissolved and becomes amenable to separation from the gangue material.
dmt	Dry metric tonne(s)
doré	Unrefined gold and silver bullion bars which will be further refined to almost pure metal.
DTM	Digital terrain model
EIA	Environmental impact assessment
Electrowinning	The process of removing mineral from solution by the action of electric currents, known as electrolysis.
EM	Electromagnetic geophysical technique
EMP	Environmental Management Plan
EMS	Environmental Management System
EoR	Engineer of Record
EPA	Environmental Protection Agency
ESG	Environmental, social and governance
ESIA	Environmental and social impact assessment
FA	Fire assay analytical technique
FCF	Free cash flow
Fe	Iron
Feasibility Study or **FS**	A Feasibility Study is a comprehensive technical and economic study of the selected development option for a mineral project that includes appropriately detailed assessments of applicable modifying factors together with any other relevant operational factors and detailed financial analysis that are necessary to demonstrate, at the time of reporting, that extraction is reasonably justified (economically mineable). The results of the study may reasonably serve as the basis for a final decision by a proponent or financial institution to proceed with, or finance, the development of the project. The confidence level of the study will be higher than that of a Pre-feasibility Study.
FIFO	Fly-in/fly-out
Footwall	The bottom side of a geological structure or mineral deposit
FOS	Factor of safety
Fx	Foreign exchange rate
g, µg, mg, kg, g/t	Gram(s), microgram(s), milligram(s), kilogram(s), grams per tonne
Ga	Giga annum or billion years
G&A	General and administration
Gangue	Commercially valueless or waste material remaining after ore extraction from rock.
GC	Grade control
GPS, DGPS	Global positioning system, Differential global positioning system
Grinding	Reducing rock to the consistency of fine sand by crushing and abrading in a rotating steel grinding mill.
ha	Hectare(s)
Hangingwall	The top side of a geological structure or mineral deposit
HME	Heavy mining equipment
HSE, HSEC	Health, safety and environment, Health, safety, environment and community
Hypogene	Ore or mineral deposits formed by ascending fluids occurring deep below the earth's surface, which tend to form deposits of primary minerals, as opposed to supergene processes that occur at or near the surface and tend to form secondary minerals.
ICMC	International Cyanide Management Code
ICP	Inductively coupled plasma analytical technique

ILR	InLine Leach Reactor
Indicated Mineral Resource	An Indicated Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics are estimated with sufficient confidence to allow the application of modifying factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit. Geological evidence is derived from adequately detailed and reliable exploration, sampling and testing and is sufficient to assume geological and grade or quality continuity between points of observation. An Indicated Mineral Resource has a lower level of confidence than that applying to a Measured Mineral Resource and may only be converted to a Probable Mineral Reserve.
Inferred Mineral Resource	An Inferred Mineral Resource is that part of a Mineral Resource for which quantity and grade or quality are estimated on the basis of limited geological evidence and sampling. Geological evidence is sufficient to imply but not verify geological and grade or quality continuity. An Inferred Mineral Resource has a lower level of confidence than that applying to an Indicated Mineral Resource and must not be converted to a Mineral Reserve. It is reasonably expected that the majority of Inferred Mineral Resources could be upgraded to Indicated Mineral Resources with continued exploration.
Initial assessment	A preliminary technical and economic study of the economic potential of all or parts of mineralisation to support the disclosure of Mineral Resources. The initial assessment must be prepared by a Qualified Person and must include appropriate assessments of reasonably assumed technical and economic factors, together with any other relevant operational factors, that are necessary to demonstrate at the time of reporting that there are reasonable prospects for economic extraction. An initial assessment is required for disclosure of Mineral Resources but cannot be used as the basis for disclosure of Mineral Reserves.
In situ	Within unbroken rock or still in the ground.
IP	Induced polarisation geophysical technique
ISO	International Organization for Standardization.
km, km^2	kilometres, square kilometres
Kriging	A geostatistical estimation technique used in the evaluation of Mineral Reserves.
L, kL, L/s	litre(s), kilolitres, litres per second
lb	Pound(s)
Leaching	Dissolution of gold from the crushed and milled material, including reclaimed slime, for adsorption and concentration onto the activated carbon.
Level	The horizontal tunnels of an underground mine used to access the workings or orebody.
Life of mine or **LoM**	The expected remaining years of production, based on production schedules and Proven and Probable Mineral Reserves.
Life of mine plan or **LoM plan**	A design and financial/economic study of an existing operation in which appropriate assessments have been made of existing geological, mining, metallurgical, economic, marketing, legal, environmental, social, governmental, engineering, operational and all other modifying factors, which are considered in sufficient detail to demonstrate that continued extraction is reasonably justified. This is completed to a minimum pre-feasibility level of study.
LHD	Load haul dump
LHOS	Long-hole open stoping
LIMS	Laboratory information management system
London afternoon fixing price	The afternoon fixing by the new electronic London Bullion Market Association, or LBMA price-discovery process. The price continues to be set twice daily, at 10:30 and 15:00 London time.
m, mm, cm, m^2, m^3	metre(s), millimetre(s), centimetre(s), square metre(s), cubic metre(s)
M	Million(s)
Ma	Mega annum or million years
MCP	Mine Closure Plan
Measured Mineral Resource	A Measured Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, and physical characteristics are estimated with confidence sufficient to allow the application of modifying factors to support detailed mine planning and final evaluation of the economic viability of the deposit. Geological evidence is derived from detailed and reliable exploration, sampling and testing and is sufficient to confirm geological and grade or quality continuity between points of observation. A Measured Mineral Resource has a higher level of confidence than that applying to either

	an Indicated Mineral Resource or an Inferred Mineral Resource. It may be converted to a Proven Mineral Reserve or to a Probable Mineral Reserve.
Metallurgical recovery factor	The proportion of metal in the ore delivered to the mill that is recovered by the metallurgical process or processes.
Metallurgy	The science of extracting metals from ores and preparing them for sale.
Mill delivered tonnes	A quantity, expressed in tonnes, of ore delivered to the metallurgical plant.
Mine call factor or **MCF**	The ratio, expressed as a percentage, of the specific product accounted for at the mill (including residue), compared to the corresponding specific product 'called for' based on an operation's measuring and valuation methods.
Mineralisation	The presence of a target mineral in a mass of host rock. A concentration (or occurrence) of material of possible economic interest, in or on the earth's crust, for which quantity and quality cannot be estimated with sufficient confidence to be defined as a Mineral Resource. Mineralisation is not classified as a Mineral Resource or Mineral Reserve and can only be reported under exploration results. The data and information relating to it must be sufficient to allow a considered and balanced judgement of its significance and the process or processes by which a mineral or minerals are introduced into rock, resulting in a potentially valuable deposit. Mineralisation generally incorporates various terms, including fissure filling, impregnation and replacement, among others.
Mineral Reserve	The economically mineable part of a Measured and/or Indicated Mineral Resource converted into Proven and Probable Mineral Reserves. It includes diluting minerals and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at Pre-feasibility or Feasibility level as appropriate that include application of modifying factors. Such studies demonstrate that, at the time of reporting, extraction could reasonably be justified. The reference point at which Mineral Reserves are defined, usually the point where the ore is delivered to the processing plant, must be stated. It is important that, in all situations where the reference point is different, such as for a saleable product, a clarifying statement is included to clarify what is being reported.
Mineral Resource	A concentration or occurrence of solid material of economic interest in or on the earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling. Gold Fields reports **Inclusive Mineral Resource** (IMR) which is the entire Mineral Resource from which the Mineral Reserve has been generated and **Exclusive Mineral Resource** (EMR) which is the Mineral Resource remaining after the Mineral Reserve has been generated. It should not be expected that IMR-Mineral Reserve is numerically equal to EMR as Mineral Reserve has had modifying factors applier and Mineral Resources have not. While some of the EMR may be converted to Mineral Reserves through additional drilling or other means, there it should not be expected that all of the EMR can be converted to Mineral Reserves.
Modifying factors	Modifying factors are considerations used to convert Mineral Resources to Mineral Reserves. These include, but are not restricted to, mining, processing, metallurgical, infrastructure, economic, marketing, legal, environmental, social and governmental factors.
MSO	Mineable shape optimiser
NaCN	Sodium cyanide
Net smelter return or **NSR**	The volume of refined mineral sold during the relevant period multiplied by the average spot mineral price and the average exchange rate for the period, less refining, transport and insurance costs.
NI 43-101	National Instrument 43-101 Standards of Disclosure for Mineral Projects published by the Canadian Securities Administrators.
NO_2	Nitrogen dioxide
NPV	Net present value
NSR	Net smelter return
OHS	Occupational health and safety
Open pit or **OP**	Mining where the ore is extracted from a surface mining operation or "pit". The geometry of the pit may vary with the characteristics of the orebody.
Opex	Operating expenditure
Ore	A mixture of material containing minerals from which at least one of the minerals can be mined and processed profitably.
Orebody	A well-defined mass of material of sufficient mineral content to make extraction economically viable.

Ore grade	The average amount of mineral contained in a tonne of mineral-bearing ore expressed in grams per tonne (g/t), or percent (%) per tonne.
Ounce or **oz, koz, Moz, oz/a**	One troy ounce which equals 31.1035 grams, kilo-ounces (or thousand ounces), million ounces, ounces per annum.
Overburden	The soil and rock that must be removed in order to expose an ore body.
P_x	Percentage (x) of material passing a specified size.
Pa, kPa, MPa	pascal(s), kilopascals, megapascals. A unit measurement of stress or pressure within the earth's crust used to profile tectonic stress, which can impact ground stability and ground support requirements in underground mining.
Paste fill or **back fill**	A technique whereby cemented paste fill is placed in mined-out voids to improve and maintain ground stability, minimise waste dilution and maximise extraction of the ore.
pH	Scale used to specify the acidity or basicity of an aqueous solution.
ppb, ppm	Parts per billion, parts per million
Pre-feasibility Study or **PFS**	A comprehensive study of a range of options for the technical and economic viability of a mineral project that has advanced to a stage where a preferred mining method, in the case of underground mining, or the pit configuration, in the case of an open pit, is established and an effective method of mineral processing is determined. It includes a financial analysis based on reasonable assumptions on the modifying factors and the evaluation of any other relevant factors which are sufficient for a Qualified Person, acting reasonably, to determine if all or part of the Mineral Resource may be converted to a Mineral Reserve at the time of reporting. A Pre-feasibility Study is at a lower confidence level than a Feasibility Study.
Probable Mineral Reserve	The economically mineable part of an Indicated, and in some circumstances, a Measured Mineral Resource. The confidence in the modifying factors applying to a Probable Mineral Reserve is lower than that applying to a Proven Mineral Reserve.
Prospecting or exploration right	Permission to explore an area for minerals.
Proven Mineral Reserve	The economically mineable part of a Measured Mineral Resource. A Proven Mineral Resource implies a high degree of confidence in the modifying factors.
PV	Photovoltaic
QAQC	Quality assurance quality control
RC	Reverse circulation drilling technique
Refining	The final stage of metal production in which final impurities are removed from the molten metal by introducing air and fluxes. The impurities are removed as gases or slag.
Rehabilitation	The process of restoring mined land to a condition approximating its original state.
RF	Revenue factor(s)
RL	Reduced level
RO	Reverse osmosis
RQD	Rock quality designation
Run of mine or **RoM**	When used with regard to grade, is a term to describe the average grade of the ore mined.
SAMREC Code 2016	The South African Code for the Reporting of Exploration Results, Mineral Resources and Mineral Reserves, 2016 Edition
Seismicity	A sudden movement within a given volume of rock that radiates detectable seismic waves. The amplitude and frequency of seismic waves radiated from such a source depend, in general, on the strength and state of stress of the rock, the size of the source of seismic radiation, and the magnitude and the rate at which the rock moves during the fracturing process.
Semi-autogenous grinding or **SAG mill**	A piece of machinery used to crush and grind ore which uses a mixture of steel balls and the ore itself to achieve comminution. The mill is shaped like a cylinder causing the grinding media and the ore itself to impact upon the ore.
Shotcrete	A sprayed concrete or specialist cement type product applied through a hose or similar device and pneumatically projected at high velocity on the surface of excavations, as a geotechnical ground support technique to reinforce the stability of underground faces.

Slimes	The finer fraction or tailings discharged from a processing plant after the valuable minerals have been recovered. Also see 'Tailings'
Slurry	A fluid comprising fine solids suspended in a solution (generally water containing additives).
Smelting	Thermal processing whereby a mineral is liberated from molten beneficiated ore or concentrate, with impurities separating as lighter slag.
SMU	Selective mining unit
SO_2	Sulfur dioxide
SOX	Sarbanes-Oxley Act of 2002 - embedded risk and control matrix (RACM)
Spot price	The current price of a metal for immediate delivery.
Stockpile or **SP**	A store of unprocessed ore, which is material resulting from mining or processing operations.
Stope	The underground excavation within the orebody where the main mineral production takes place.
Stratigraphic	The study of rock layers (strata) and layering (stratification) and is primarily used in the study of sedimentary and layered volcanic rocks. Stratigraphic modelling is often important in profiling the regional and local geology that has played a controlling role in mineralisation and orebody generation.
Stripping	The process of removing overburden (waste material) to expose the ore for mining.
Sulphide	A mineral characterised by the linkages of sulphur with a metal or semi-metal, such as pyrite (iron sulphide). Also a zone in which sulphide minerals occur.
Supergene	Ores or ore minerals formed where descending surface water oxidises the primary (hypogene) mineralised rock and redistributes the ore minerals, often concentrating them in zones. Supergene enrichment occurs at the base of the oxidised portion of the ore deposit.
Tailings	Finely ground rock from which the bulk of valuable minerals have been extracted by metallurgical processes. Also see 'Slimes'.
Tailings storage facility or **TSF**	A dam used to store by-products or tailing from mining operations after separating the ore from the gangue.
TCRC	Treatment charges and refining charges
TDS	Total dissolved solids
Tonne or **t, kt, Mt, t/a, Mt/a**	One tonne is equal to 1,000 kilograms (also known as a "metric" tonne), kilo-tonnes (or thousand tonnes), million tonnes, tonnes per annum, million tonnes per annum.
Tonnage	The quantity of material where the tonne is an appropriate unit of measure. Typically used to measure reserves of mineral-bearing material, or quantities of ore and waste material mined, transported or milled.
Underground or **UG**	Mining where the ore is extracted from an underground mining operation.
V, kV, kVA	Volt(s), kilovolt, kilovolt-ampere
W, kW, kWh, MW	Watt, kilowatt, kilowatt-hour, megawatt
WAD CN	Weak acid dissociable cyanide
Waste	Rock mined with an insufficient mineral content to justify processing.
Waste storage facility or WSF	A rock dump used to store accumulations of waste or low-grade material derived in the course of mining.
wmt	Wet metric tonne(s)
wt%	weight percent
XRD	X-ray diffraction analytical technique
XRF	X-ray fluorescence analytical technique
Yield	The actual grade of ore realised after the mining and metallurgical treatment process.