HILLGROVE RESOURCES

ASX RELEASE

30 October 2019

# MAIDEN KAVANAGH UNDERGOUND MINERAL RESOURCE ESTIMATE

Hillgrove Resources Limited (ASX:HGO, the "Company") advises that a new Mineral Resource Estimate has been prepared for the Central and East Kavanagh underground area at the Kanmantoo Copper Mine in accordance with The JORC Code 2012 Edition. Highlights include:

- The copper grade of the resource estimate indicates that the grade and dimensions of the orebodies may be suitable for underground mining.
- the resource estimate only covers a portion of the Central and East Kavanagh areas and there is considerable opportunity to increase the resource with further drilling on Central and East Kavanagh and drilling of the identified West Kavanagh Exploration Target[1].
- The resource estimate is constrained by the extent of the drilling and not by the geology, in both the along strike and dip directions.
- The Mineral Resource Estimate will now be subjected to mine design, optimisation and feasibility studies, as permitting, finance and an agreement with AGL over mine life are finalised.

**Table 1** summarises the Mineral Resource Estimate ("MRE") for the Central and East Kavanagh underground areas between 900 and 750 mRL at 0.6% Cu cut-off grade.

**Table 1 Mineral Resource Estimate for Central and East Kavanagh underground area**

| Mine | JORC 2012 Classification | Tonnage (kt) | Cu (%) | Au (g/t) | Ag (g/t) | Cu Metal (kt) |
|---|---|---|---|---|---|---|
| Kavanagh UG | Indicated | 646 | 1.63 | 0.13 | 3.6 | 10.5 |
| | Inferred | 310 | 1.8 | 0.2 | 4 | 6 |
| | **Total** | **957** | **1.7** | **0.14** | **3.8** | **16.2** |

Note: Copper Cut Off Grade is 0.60% Cu. Due to appropriate rounding, numbers may not sum.

## Mineral Resource Estimate

The underground Mineral Resource Estimate has incorporated the 2019 diamond drilling results (KTDD187* as released on 10 October 2019) with the earlier 2006 diamond drill results in the area, specifically diamond drill holes KTDD027, 029, 071 and 149. The estimate does not include any pre-2004 drilling, previously identified as the KS* drill holes drilled in 1960 -1976.

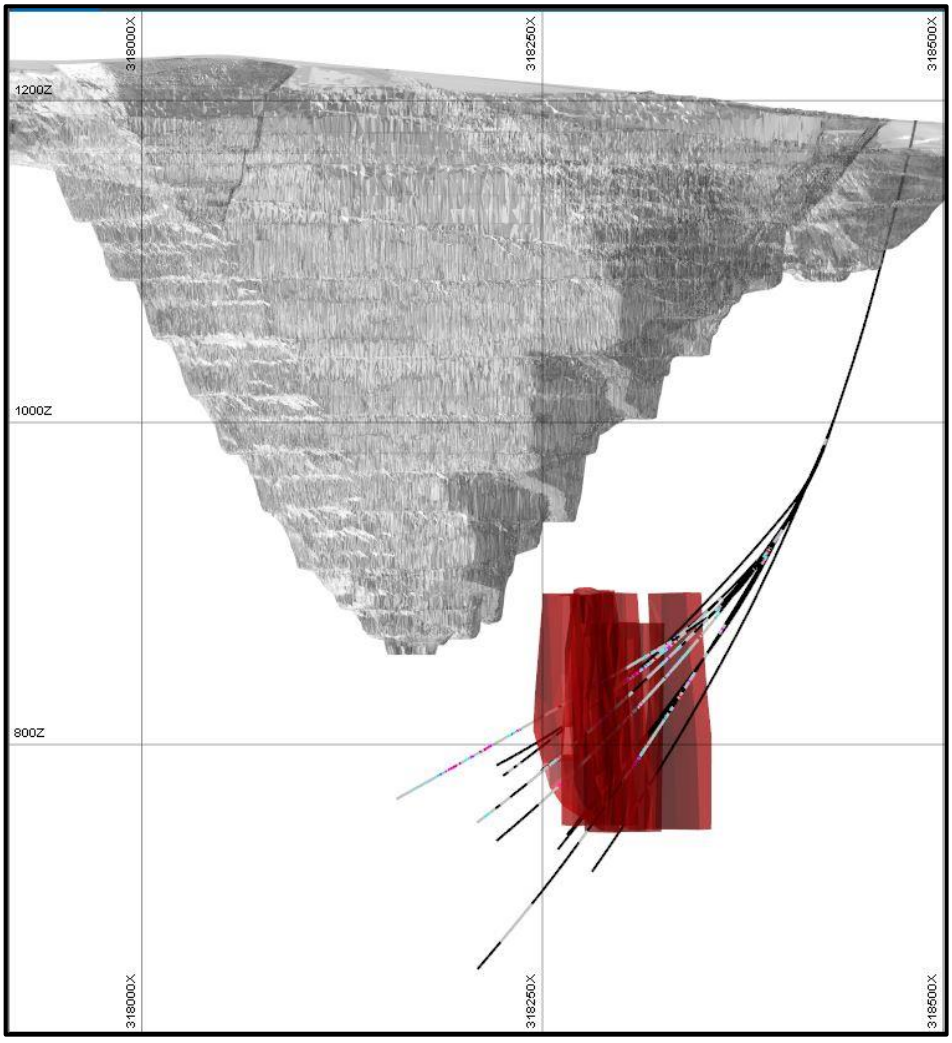
[1] The Exploration Target is conceptual in nature as there has been insufficient exploration to define a Mineral Resource. It is uncertain if further exploration will result in the determination of a Mineral Resource under the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, the JORC Code" (JORC 2012). The Exploration Target was reported 25 May 2017

All diamond drill core from the 2019 drill program has been logged lithologically, structurally, and geotechnically. Overall, core recovery was > 98% and RQD > 98%.

In addition 73 bulk density recordings were collected to add to the previous density data set and re-affirm the validity of the assigned 3.1 t/m3 bulk density used for the estimation.

See **Appendix 1** for the JORC compliant Table 1 for a description of the sampling, assaying and resource estimation processes.

**Figure 1 Location of 2019 Mineral Resource Estimate and 2019 drill holes**




## Geologic Domains

Two geologic entities within the Kavanagh area have been wireframed based on the alteration and mineralisation as logged by the exploration staff. These are termed the Central Kavanagh and East Kavanagh lodes and have been mined in the Giant open pit from surface to over 250m depth.

The domains have only been interpreted over 150m of strike within a zone that was mined over 350m strike length within the open pit.

All areas within this resource estimate are totally within fresh rock.

**Estimation Method**

Ordinary Kriging has been used to estimate the Cu, Au and Ag grades of each resource block of 4m by 8m by 4m within the interpreted domain wireframes. Any mineralisation outside of the two mineralised domains has been excluded from the estimate.

The resultant Mineral Resource Estimate (**Table 1**) has been reported at a 0.6% Cu cut-off grade, between 900 and 750 m RL and within the two domains.

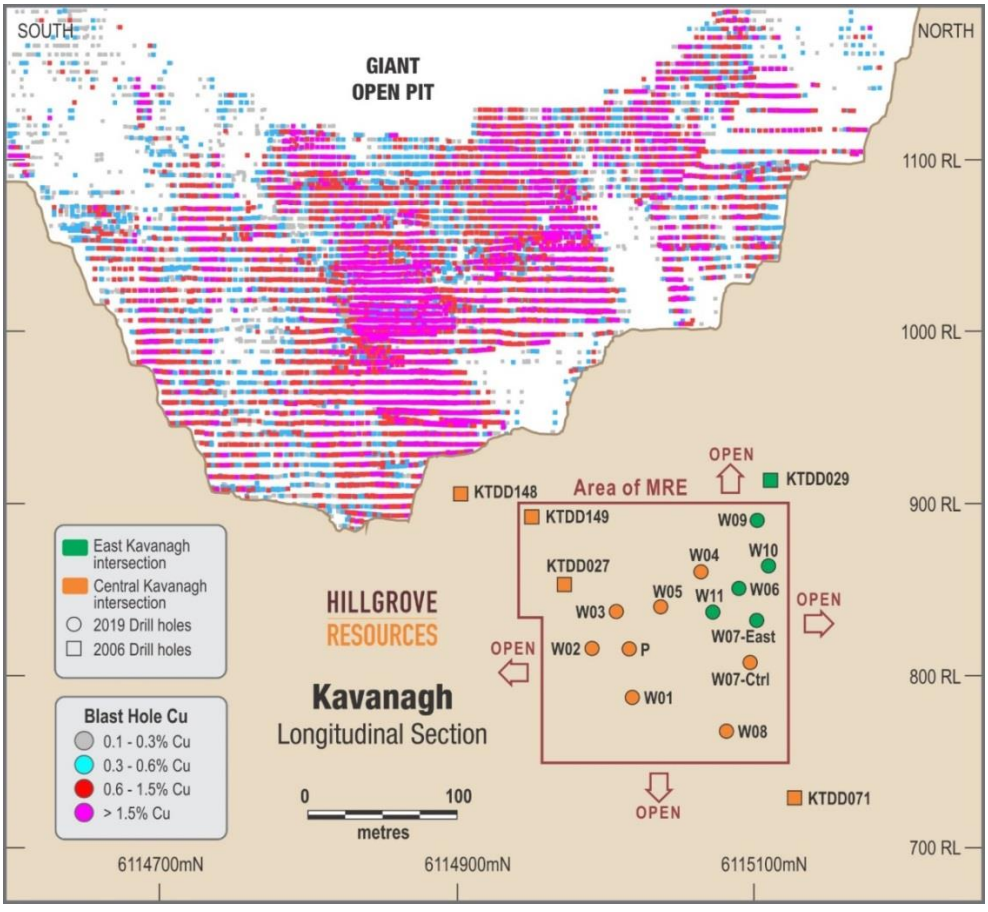
**Resource Classification**

Three estimation passes were used, with each pass providing an increase to the search strategy from 30m x 50m x 8m (east, north, elev) to a maximum of 45m x 75m x 12m. Indicated were coded where a block was estimated with more than 16 composites, from a minimum of 4 octants.

Panels were classified Inferred if they were estimated with the largest search strategy and 8 composites within a minimum of 2 octants.

Visual review of the location of the Inferred blocks against the drilling density affirmed the appropriateness of the resource classifications.

**Figure 2 Longitudinal section of the drill holes and the extent of the MRE**



## Future Activities

A further drilling program is scheduled to commence in the last quarter of 2019. The drilling program will target the Western Kavanagh lode system which drove the optimal shape of the open pit, and pending success, the strike extensions of the Central Kavanagh orebody.

**Figure 3 Plan view of Tenement and Project Map – South Australia**



## ABOUT HILLGROVE

Hillgrove is an Australian mining company listed on the Australian Securities Exchange (ASX: HGO) focused on the operation of the Kanmantoo Copper Mine in South Australia. The Kanmantoo Copper Mine is located less than 55 kilometres from Adelaide in South Australia.

### Competent Person's Statement

The information in this release that relates to the 2019 Mineral Resource Estimate for the Central and East Kavanagh underground area is based upon information compiled by Mr Peter Rolley, who is a Member of The Australian Institute of Geoscientists. Mr Rolley is a full-time employee of Hillgrove Resources Limited and has sufficient experience relevant to the styles of mineralisation and type of deposit under consideration to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code)'. Mr Rolley has consented to the inclusion in the release of the matters based on their information in the form and context in which it appears.

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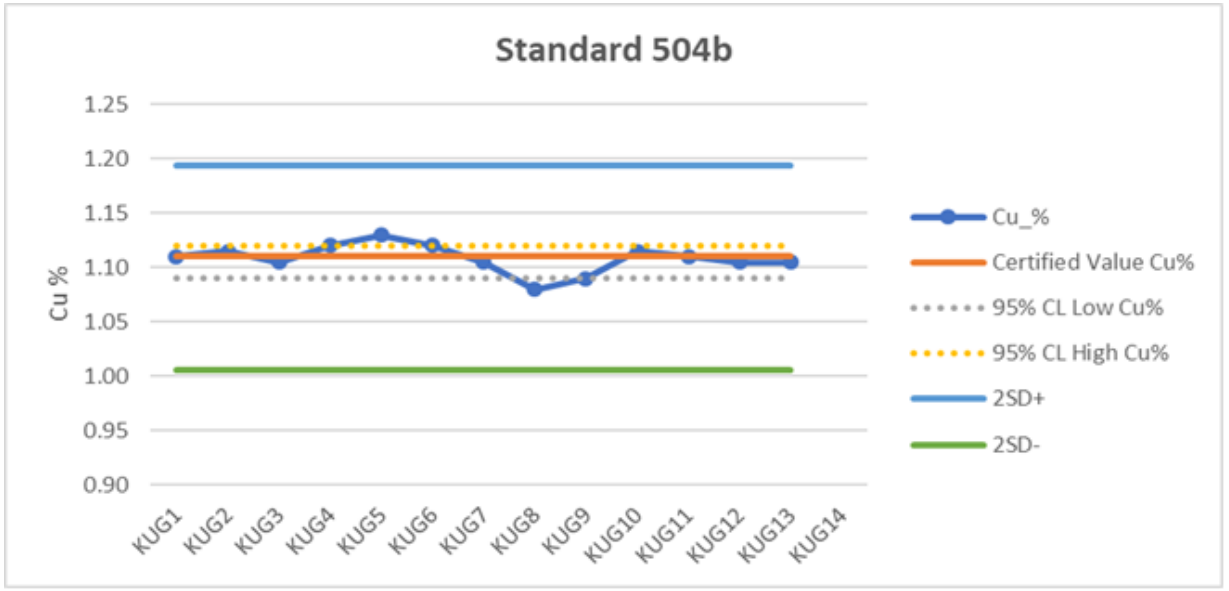
**APPENDIX A – JORC Table 1**

# Section 1 Sampling Techniques and Data

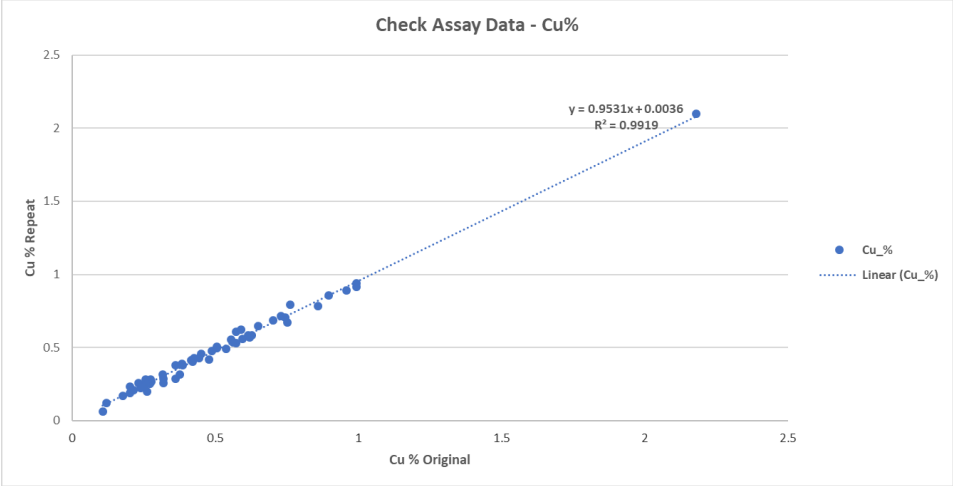
| Criteria | Commentary |
|---|---|
| *Sampling techniques* | • Diamond drill hole (DD) samples collected by Hillgrove Resources personnel have been used for the geological interpretation and estimation. No historic pre-2004 samples have been used in this mineral resource estimate. Four diamond drill holes used in the resource estimate were drilled by Hillgrove in 2004 – 2010 are KTDD027, KTDD029, KTDD071 and KTDD149. Twelve diamond drill holes were drilled by Hillgrove in 2019 are KTDD187 and associated wedges.<br>• Drill hole sampling was conducted as per the Hillgrove Resources procedures and QAQC protocols.<br>• Core samples were sawn in half using a diamond core saw. In addition, ½ core from KTDD027 was sawn into quarter and re-assayed as a QA of the previous diamond drillhole results before being utilised in this resource estimate. All sampling was undertaken at 1m intervals or to geological boundaries as determined by the supervising geologist. Half core samples were sent for assay and the remaining core kept in core trays for future reference. |
| *Drilling techniques* | • All drilling was undertaken by an external drilling contractor.<br>• Drilled using a combination of RC and HQ Diamond for the pre-collar and NQ2 through all the mineralised zones (including as wedges) |
| *Drill sample recovery* | • Diamond core recovery is recorded by Hillgrove Field Technicians during metre marking and orientation of all holes by comparing the length of drill hole advance to the recovered core metres. Results demonstrate good recoveries with an average recovery rate of >98%. There is no correlation between sample recovery and copper grades. |
| *Logging* | • All diamond core is logged for lithology, alteration, weathering and mineralisation by Hillgrove Geologists in accordance with Hillgrove's Core Logging Procedure. Colour and any additional qualitative comments were also recorded.<br>• In addition, a structural log is recorded utilising the "base of core" orientation mark collected during diamond drilling<br>• 99% of all diamond holes have been geotechnically logged.<br>• All diamond core trays were photographed before sampling and these photographs are stored on the Hillgrove server.<br>• All drill core is stored at Hillgrove's Kanmantoo core yard facility.<br>• All geological logging is recorded into Excel spread sheet templates and visually validated before being imported into the Hillgrove Datashed drillhole database. Additional validation is conducted automatically on import. |
| *Sub-sampling techniques and sample preparation* | • The core was sawn in half and the half core was despatched to ALS for each sample interval and the entire sample was then crushed and 1kg rifle split from the crushed mass and the 1kg sample then pulverised. A sub-split of 200 grams was then spilt by ALS and retained and the reject pulverised material retuned to Hillgrove. From the 200 gram sub-spilt and 2 gram aliquot was scooped and weighed by ALS for 4-acid digestion.<br>• Hillgrove have detailed sampling and QAQC procedures in place to ensure sample collection is carried out to maximise representivity of the samples and minimise contamination. |
| *Quality of assay data and laboratory tests* | • Pre 2011, all samples were submitted to Genalysis for analysis. Gold was determined by fire assay with flame AAS (FA50) and copper analysed via a mixed acid digest (method AT) with determination by Optical Emission Spectrometry (OES). If the copper result was greater than 1%, the analysis was repeated using a slightly modified mixed acid digestion technique (method AX). |

| Criteria | Commentary |
|---|---|

- Post 2011 samples were submitted to ALS Perth for assaying by four acid digest with ICP-AES analysis (ALS code ME-MS61) and gold was analysed via fire assay and Atomic Absorption Spectroscopy (AAS).
- The QAQC of sample preparation and analysis processes were via the following samples:
  - Certified reference materials (CRMS) from OREAS were inserted into the sample sequence at a frequency of one in 20.
  - Standards of > 1.0% Cu were used to reflect the copper grade closer to the expected grade of any subsequent UG operation.




  - Blanks inserted at a rate of one in every 20 samples, and specifically inserted in areas of high sulphides.
  - Laboratory QAQC samples were inserted with a minimum of two standards and one blank for every batch of 40 samples.
- Hillgrove's Quality policy is that at a minimum of 5% of all samples are CRM's and 5% of samples submitted are blanks,10% of all samples submitted for analysis are QAQC samples.
- Results from all returned QAQC samples provide reasonable confidence as to the accuracy of the assay results used in the estimation. Field duplicates show a good correlation with original sample results and in general most CRM results fall within the expected ranges.
- Repeats of the coarse crush rejects was also undertaken. This shows excellent correlation with the original assay results as shown below.

| Criteria | Commentary |
|---|---|
| |  |
| *Verification of sampling and assaying* | • Umpire laboratory checks were undertaken during 2008 and 2011 with no significant issues identified.<br>• There have been no twinned holes drilled for the Kanmantoo Copper Mineral Resource.<br>• Primary sample data is captured in the field into Excel templates and stored on the Hillgrove server. The Excel templates were then imported into the SQL database using data entry procedures and database import tools. Data was visually checked by the Geologist prior to import and additional validation was carried out by the database upon import.<br>• Copper results were reported in ppm units from the laboratories and then converted to a % value within the database. |
| *Location of data points* | • The map projection of Map Grid of Australia 1994 - Zone 54, (MGA94-54) was used all work undertaken for this Mineral Resource.<br>• The relative level (RL) has been calculated as RL+1000m to ensure no negative RL values within the dataset.<br>• All drillhole collars surveyed using a Trimble survey station. The accuracy of this instrument is 10mm in the horizontal plane and 20mm in the vertical. All pick-ups were reported in MGA94-54 coordinate system.<br>• Downhole surveys were determined using a Champ Gyro tool from Axis Mining Technology at a maximum of 12m intervals.<br>• The Champ GYRO™ accuracy is specified at +/- 0.75° (latitude dependent) for azimuth and +/- 0.15° for inclination. It has an operating range of -20° to -90° and +20° to +90° and can operate in temperatures between -10°c to + 70°c. All of these operating specifications are within that of the drilling program.)<br>• The azimuth data recorded by the Champ GYRO™ as True North and as such no data conversions were required.<br>• To monitor the accuracy of the down hole surveys two holes were checked by completing multi-shot surveys on retreat. These surveys were aligned with the downhole surveys collected when drilling and as such no further multi shot check surveys were required. |
| *Data spacing and distribution* | • Drilling was completed throughout the deposit on a variable section spacing of between 15 m to 40m and an on-section down-dip spacing of between 30 m and 50m.<br>• The variable drill spacing both along strike and on-section was considered during resource classification; mineralisation estimated on broader spaced |

| Criteria | Commentary |
|---|---|
| | drilling was given a lower confidence classification than mineralisation estimated using tighter spaced drilling.<br>• All samples were composited to 1m lengths prior to geostatistical analysis and Mineral Resource estimation. |
| *Orientation of data in relation to geological structure* | • The majority of holes are angled drillholes, dipping between -29º and -45º deg towards 250-280 deg (true). This is approximately normal to the observed strike of the mineralisation from in-pit mapping.<br>• Dominant mineralisation trends as measured from in-pit mapping are strike 015deg and dip -75 to east. |
| *Sample security* | • A Hillgrove employee is present for the collection of the core trays from the DDH rig and is responsible for collecting and organising the samples for assay. Hillgrove has a detailed sample collection/submission procedure in place to endure sample security.<br>• Drill core is transported in covered trays from the drill site to Hillgrove's core yard at Kanmantoo in Hillgrove vehicles under the supervision of Hillgrove staff.<br>• Transport of the half-sawn drill core samples is by dedicated road transport to the Adelaide ALS sample preparation facility. All samples are transported in sealed plastic bags and are accompanied by (either paper form or by email) a detailed sample submission form generated by the Field Technician.<br>• On receiving a batch of samples, the receiving laboratory checks received samples against a sample dispatch sheet supplied by Hillgrove personnel. On completion of this check a sample reconciliation report is provided for each batch received. |
| *Audits or reviews* | • Core logging and sampling methods were reviewed by Runge in 2008 and were considered to be of a very high standard (report: Mineral Resource Estimate Kanmantoo Copper Deposit South Australia, Feb 2008). |

## Section 2 Reporting of Exploration Results

| Criteria | Commentary |
|---|---|
| *Mineral tenement and land tenure status* | • The Kanmantoo Copper Deposit is situated 55kms south-east of Adelaide on Mining Lease (ML) 6345 and is owned 100% by Hillgrove Resources Limited (HGO).<br>• The Mining Lease overlies freehold land also held by Hillgrove Resources.<br>• There are no Native Title interests, nor are there any historical or environmental issues considered material to this Mineral Resource. |
| *Exploration done by other parties* | • The Kanmantoo Copper Deposit has a long history of exploration and mining dating back to the mid-19$^{th}$ century.<br>• In 1962, Mines Exploration Pty Ltd discovered a number of strong geophysical anomalies which were quickly followed up by a large diamond drilling program of 15,800m. The results of this program led to a decision to begin mining in 1968. The open pit closed in 1976.<br>• Hillgrove Resources commenced exploration drilling in 2004 and since then have completed a number of exploration drill campaigns which have resulted in extensions and additions to the known deposit.<br>• Open pit mining by Hillgrove concluded in April 2019<br>• All exploration data used in this resource estimate has been collected by Hillgrove staff. |
| *Geology* | • Mineralisation occurs as a complex system of structurally controlled veins, with mineralisation typically forming pipe-like bodies and lenses of chalcopyrite, pyrrhotite, pyrite, magnetite, chalcocite and bornite within a quartz + biotite + andalusite ± garnet ± chlorite schist host rock. Structural studies suggest the main controls on the mineralisation are north-south striking shear zones and north-north-east/north-east striking cross-shears and tension veins. |
| *Drill hole Information* | • No exploration results have been reported in this release, therefore this section is not material to this report. |
| *Data aggregation methods* | • No weighting average techniques or grade truncations have been reported in this release.<br>• No metal equivalent values have been reported. |
| *mineralisation widths and intercept lengths* | • No exploration results have been reported in this release, therefore this section is not material to this report. See the ASX release of 10 October 2019. |
| *Diagrams* | • Diagrams that are relevant to this release have been included in the body of the release. |
| *Balanced reporting* | • No exploration results have been reported in this release, therefore this section is not material to this report. |
| *Other exploration data* | • No exploration results have been reported in this release, therefore this section is not material to this report. |
| *Further work* | • No exploration results have been reported in this release, therefore this section is not material to this report. |

## Section 3 Estimation and Reporting of Mineral Resources

| Criteria | Commentary |
|---|---|
| *Database integrity* | • Hillgrove Resources utilise an SQL database system which is managed by the Database Controller assisted by the Senior Geologist.<br>• Primary data is collected electronically into excel templates with lookup tables and fixed formatting to aid validation. Primary data is stored on Hillgrove's server and then imported into the SQL database using detailed data entry standards and database import tools.<br>• Data is visually checked and validated prior to being imported into the SQL database and additional validation is performed on import via a number of embedded validation rules within the SQL database system. This automatic validation is configured through the use of library tables, triggers and stored procedures designed to ensure data integrity with respect to a number of fundamental quality essentials. Any data which violates these rules is rejected and quarantined until the errors are corrected.<br>• Data tables were exported from the SQL database as comma separated files (CSV's) using export tools embedded with the database. |
| *Site visits* | • The Competent Person works at the Kanmantoo Copper mine and is involved with the recent drilling and data collection processes. The Competent Person has also viewed all of the older diamond core and all of the recent diamond core. The Competent Person has also been involved in the open pit daily grade control processes and therefore has an understanding of the spatial continuity of the mineralised ore zones in 3D. |
| *Geological interpretation* | • Structural studies conducted by Hillgrove denote that the main controls on mineralisation are the north -south striking anastomosing shear zones and the north-east to north-north-east striking cross-shears and tension veins. This strong structural control is evident throughout the entire deposit and often generates rapid changes to mineralisation over very short distances.<br>• The dip of the mineralisation is generally steeply dipping (70º to 80º) towards the East.<br>• Open pit mining of the Central Kavanagh mineralisation has revealed that the mineralisation and host structures are more complex than can be detailed by the spacing of the exploration drilling.<br>• Geologic domains were predominately modelled on chlorite, sulphur and copper content with a moderate influence from structural knowledge gained during mining. The logging can be very difficult to spatially model and interpret due to geological complexity.<br>• Throughout the deposit the geological continuity of both the mineralisation and its host structures varies significantly.<br>• Domains were projected around 10m beyond the limit of drilling.<br>• Only two domains were interpreted, Central Kavanagh and East Kavanagh. Any mineralisation intersected by the drilling, but not included in these domains is not included in the resource estimate. |
| *Dimensions* | • The Central and East Kavanagh underground Mineral Resource model has a north-south strike length of 150 metres, over a zone approx. 50m wide and over a depth of 150 metres. This is only a portion of the Central Kavanagh mineral system which extends over 350 metre in length and is open to depth.. |
| *Estimation and modelling techniques* | • The three dimensional mineralisation wireframes were completed using Micromine 2011 Ver 12.5.2<br>• Domain interpretation updates were completed using 10m spaced sections.<br>• Wireframe objects for the two domains at Kavanagh were built for the modelling method.<br>• Modelling of mineralisation was completed using copper intervals, where copper was greater than 0.3% across consecutive drillholes. Where there was not consecutive drillholes with greater than 0.3% copper these zones were excluded.<br>• Major geological domains were interpreted predominately on mineralisation.<br>• Sectional interpretations were extrapolated to 750m RL down-dip. Along strike, mineralisation was extrapolated to 10m from the section. |

| Criteria | Commentary |
|---|---|

GRADE ESTIMATION

- Block estimation and geostatistical analysis was completed within the GS3M software package of FSSI Australia.
- Block size was defined by the nature of the orebody and the drillhole spacing.

| Model Extents | East | North | Elev |
|---|---|---|---|
| **Minimum** | 318220 | 6114986 | 752 |
| **Maximum** | 318364 | 6115154 | 948 |
| **Block size (m)** | 4 | 8 | 4 |
| **Discretisation points** | 4 | 8 | 4 |

- Ordinary Kriging (OK) was used to estimate copper, silver and gold grades.
- Each element within each domain was analysed for the presence of extreme high values and top cut values were applied on an element and domain basis where applicable prior to compositing. Top cut values were determined using basic statistical analysis, assessment of log probability plots and spatial evaluation of high outliers.

| Raw data Top Cuts | |
|---|---|
| Cu | 6% |
| Au | 1.4g/t |
| Ag | 20g/t |

- The mineralised domain boundaries were used as “soft” boundaries for interpolation.
- One metre assay composites from start of hole were used for interpolation
- The variography, conditional statistics for each domain for each metal were generated from the domained 1m composites.
- Three estimation passes were employed for all domains, each subsequent pass having an increased search size. These search parameters were determined using drill hole density and variography as a guide.

  - Estimation Parameters
  - East North Elev
  - Search 1 30 50 8
  - Search 2 45 75 12
  - Search 3 45 75 12
  - Min data - Search 1&2 16
  - Min data - Search 3 8
  - Min quadrants - Search 1&2 4
  - Min quadrants - Search 1&3 2
  - Max data 32
  - Rotation z=70 x=80

| Criteria | Commentary |
|---|---|
| | • The model has been reviewed in both along section and in plan for consistency against the drillhole data. |
| *Moisture* | • Tonnages are estimated on a dry basis. |
| *Cut-off parameters* | • A 0.6% copper cut-off has been applied for reporting of the Mineral Resource. This grade is considered by Hillgrove Resources to be the economically viable lower cut-off grade. |
| *Mining factors or assumptions* | • The estimated resource is spatially limited to the anticipated underground mine parameters (due to proximity of the pit shell) and to the depth as per drilling extents. |
| *Metallurgical factors or assumptions* | • No metallurgical assumptions have been included in the resource<br>• The Kanmantoo Copper Mine Processing Plant has been processing the Kanmantoo Ore for approximately 8 years with as expected recoveries for copper, gold and silver. |
| *Environmental factors or assumptions* | • Waste dumping areas and tailing storage facilities (TSFs) are already approved and constructed within the current mining lease.<br>• Both the mine and processing plant are under full regulatory approved environmental licences and permits. |
| *Bulk density* | • Density was measured on core samples from the 2019 drilling using the wet immersion method on 73 NQ and NQ half core samples.<br>• Historical 2004-2010 collected wax-coated Archimedes method density sample results were reviewed for this Mineral Resource. The density results for 386 half core samples (a mixture of NQ and HQ in size) were available for density calculation.<br>• The density data results were divided by lithology and the datasets were investigated for outliers and/or suspect values. The mean of the relevant ore type dataset was then calculated and assigned to the model once the estimation process was complete.<br>• This density was aligned with the Bulk Density values that were used during mining of the pit and reconciled against mine production and milling |
| *Classification* | • The Mineral Resource has been classified into the confidence categories of Indicated, and Inferred according to geological confidence and reflect the Competent Person's view on the deposit. This confidence is based on the density of copper assay data, continuity of mineralisation and knowledge of the orebody gained during past mining activities. Other factors considered were the estimation pass associated with the block estimation.<br>• Indicated resources have an average drillhole intercept spacing of between 20 and 40m.<br>• Inferred resources have an average drillhole intercept spacing over 40m. |
| *Audits or reviews* | • An internal audit of the spatial continuity of the copper grades was undertaken and the estimate considered to be an appropriate estimate of the copper, gold and silver mineralisation suitable for evaluating the viability of an underground mining operation. |
| *Discussion of relative accuracy/ confidence* | • The model has been reviewed in both section and plan for consistency against the drill hole data.<br>• There is no reconciliation of the underground Mineral Resource against Mill production as no underground mining has been undertaken. |