Peñasquito Polymetallic Operations
Zacatecas State, Mexico
NI 43-101 Technical Report

Report Effective Date:

30 June 2018

Prepared for Goldcorp Inc. by:

Mr. Victor Vdovin, P.Eng.

Dr. Guillermo Pareja, P.Geo.

Mr. Peter Lind, P.Eng.

CERTIFICATE OF QUALIFIED PERSON

I, Mr Victor Vdovin, P.Eng., am employed as a Mining Manager, with subsidiary of Goldcorp Inc, Minera Penasquito S.A de C.V with an address of Primavera 2-A, Canada del Sol Guadalupe, Zacatecas, Postal code: 98619, Mexico

This certificate applies to the technical report titled "Peñasquito Polymetallic Operations, Zacatecas State, Mexico, NI 43-101 Technical Report" with an effective date of 30 June, 2018 (the "technical report").

I am a Professional Engineer (P.Eng. #100148678) registered with Professional Engineers, Ontario, Canada. I am a graduate of Kyrgyz-Russian Slavic University, Kyrgyzstan, (B.Eng. in Physical Processes in Mining, 2002), the Camborne School of Mines, United Kingdom, (Msc in Applied Geotechnics, 2004), and Rotman School of Management, Toronto, Canada (MBA, 2012).

I have practiced my profession since 2002, and have been involved in mine design and engineering, economic analyses, financial evaluations, and feasibility studies on gold deposits around the world.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43–101 *Standards of Disclosure for Mineral Projects* (NI 43–101) for those sections of the technical report for which I am responsible for preparing.

I work full time at Penasquito site as of November 2016 and was involved with Penasquito operations since I joined Goldcorp in February 2015.

I am responsible for Sections 1.1-1.5, 1.13, 1.14, 1.16, 1.18-1.21; Section 2, Section 3, Section 4, Sections 5.1-5.5, Section 15; Section 16, Section 18, Section 20, Section 21; Section 22, Section 24, Sections 25.1, 25.2, 25.7, 25.8, 25.10, 25.12-25.15; Section 26.3, and Section 27 of the technical report.

I am not independent of Goldcorp Inc. as independence is described by Section 1.5 of NI 43–101. I have been involved with the Peñasquito Operations since 2015.

I have read NI 43–101 and the sections of the technical report for which I am responsible have been prepared in compliance with that Instrument.

As of the effective date of the technical report, to the best of my knowledge, information and belief, the sections of the technical report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the technical report not misleading.

Dated: 1st August 2018

"Signed and sealed"

Mr Victor Vdovin, P.Eng.

CERTIFICATE OF QUALIFIED PERSON

I, Dr Guillermo Pareja, P.Geo., am employed as a Manager, Mineral Resources, with Goldcorp Inc. with an address of 3400 - 666 Burrard Street, Vancouver, BC Canada V6C 2X8.

This certificate applies to the technical report titled “Peñasquito Polymetallic Operations, Zacatecas State, Mexico, NI 43-101 Technical Report” with an effective date of 30 June, 2018 (the “technical report”).

I am a Professional Geoscientist (P.Geo. #35049) registered with Engineers and Geoscientists British Columbia (EGBC), Canada. I am a graduate of Universidad Nacional de Ingenieria, Lima, Peru (B.Sc in Geology, 1989) and of the Leland Stanford Junior University, USA (Ph.D. in Geology, 1998).

I have practiced my profession since 1989, and have been involved in mineral exploration, data verification and QA/QC, mine-site geology and operations, Mineral Resource estimation, and feasibility studies on numerous underground and open pit base metal and gold deposits all over the world, but particularly in the Americas.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43–101 *Standards of Disclosure for Mineral Projects* (NI 43–101) for those sections of the technical report for which I am responsible for preparing.

I have travelled to the Peñasquito Operations at least once a year every year since 2009. The dates of my most recent personal inspection of the Peñasquito property was 17-31 October 2016.

I am responsible for Sections 1.6, 1.7 1.8, 1.9, 1.10, 1.12, 1.20, 1.21; Sections 2.2, 2.3, 2.4, 2.5, 2.6, 2.7; Section 3; Section 6, Section 7, Section 8, Section 9, Section 10, Section 11, Section 12, Section 14, Section 23, Sections 25.3, 25.4, 25.6, 25.15, Section 26.1, and Section 27 of the technical report.

I am not independent of Goldcorp Inc. as independence is described by Section 1.5 of NI 43–101.

I have been involved with the Peñasquito Operations since 2009. I have previously co-authored the following technical reports on the operations:

- Redmond, D., Goodman, S., Peraja, G., De Ruijter, A., 2016: Peñasquito Polymetallic Operations, Zacatecas State, Mexico, NI 43-101 Technical Report, effective date 31 December 2015;

- Belanger, M., and Pareja, G., 2014: Peñasquito Polymetallic Operation Zacatecas State Mexico, NI 43-101 Technical Report: NI 43-101 technical report prepared for Goldcorp, effective date 8 January 2014;

- Belanger, M., Pareja, G., Chen, E. and Nahan, P., 2011: Peñasquito Polymetallic Operation, Zacatecas State, Mexico, NI 43-101 Technical Report: NI 43-101 technical report prepared for Goldcorp, effective date 31 December, 2011;

I have read NI 43–101 and the sections of the technical report for which I am responsible have been prepared in compliance with that Instrument.

As of the effective date of the technical report, to the best of my knowledge, information and belief, the sections of the technical report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the technical report not misleading.

Dated: 1st August 2018

“Signed”

Dr Guillermo Pareja, P.Geo.

CERTIFICATE OF QUALIFIED PERSON

I, Mr Peter Lind, P.Eng., am employed as a Director, Metallurgy Projects, with Goldcorp Inc. with an address of 3400 - 666 Burrard Street, Vancouver, BC Canada V6C 2X8.
This certificate applies to the technical report titled “Peñasquito Polymetallic Operations, Zacatecas State, Mexico, NI 43-101 Technical Report” with an effective date of 30 June, 2018 (the “technical report”).

I am a Professional Engineer (P.Eng. #31121) registered with Engineers and Geoscientists British Columbia (EGBC), Canada, and the Ordre des ingénieurs du Québec (#133650). I am a graduate of Laurentian University, Sudbury, Canada (B.Eng. in Extractive Metallurgical Engineering, 2002), the University of Windsor, Windsor, Canada (B.Comm., 2006), and Simon Fraser University, Vancouver, Canada (MBA in Management of Technology, 2017).

I have practiced my profession since 2002, and have been involved in metallurgical operations, metallurgical testwork, process design and engineering, and feasibility studies on base metal and gold deposits around the world.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43–101 *Standards of Disclosure for Mineral Projects* (NI 43–101) for those sections of the technical report for which I am responsible for preparing.

I have travelled to the Peñasquito Operations at least once a year every year since 2016. The dates of my most recent visit to the Peñasquito property was May 7 – 11, 2018.

I am responsible for Sections 1.11, 1.15, 1.17, 1.18, 1.20, 1.21; Sections 2.2, 2.3, 2.4, 2.6, Section 3; Section 13; Section 17; Section 19; Section 21; Sections 25.5, 25.9, 25.11, 25.13, 25.15; Section 26.2; and Section 27of the technical report.

I am not independent of Goldcorp Inc. as independence is described by Section 1.5 of NI 43–101. I have been involved with the Peñasquito Operations since 2016.

I have read NI 43–101 and the sections of the technical report for which I am responsible have been prepared in compliance with that Instrument.

As of the effective date of the technical report, to the best of my knowledge, information and belief, the sections of the technical report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the technical report not misleading.

Dated: 1st August 2018

“Signed and sealed”

Mr Peter Lind, P.Eng.

IMPORTANT NOTICE

This report was prepared as a National Instrument 43-101 Technical Report by Goldcorp Inc. The quality of information, conclusions, and estimates contained herein are based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. Except for the purposes legislated under Canadian provincial securities law, any other uses of this report by any third party is at that party's sole risk.

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1.0 SUMMARY

1.1 Introduction

Mr. Victor Vdovin, P.Eng., Dr. Guillermo Pareja, P.Geo., and Mr. Peter Lind, P.Eng. (the Qualified Persons or QPs) prepared this Technical Report (the Report) for Goldcorp Inc. (Goldcorp) on the wholly-owned Peñasquito Polymetallic Operations (the Peñasquito Operations or the Project) located in the state of Zacatecas, Mexico.

The Peñasquito Operations contain the Peñasco and Chile Colorado deposits. Open pit mining commenced in 2010 and full production commenced during 2011. The open pit feeds both a sulphide concentrator (mill) and a heap leach pad. The operating entity is an indirectly wholly-owned Goldcorp subsidiary, Minera Peñasquito S.A. de C.V. (Minera Peñasquito). For the purposes of this Report, "Goldcorp" is used to refer interchangeably to the parent and subsidiary company.

This Report is being filed in support of Goldcorp's Short Form Base Shelf Prospectus and its public disclosure relating to the Peñasquito Operations.

Currency is expressed in US dollars (US$).

1.2 Location, Climate, and Access

The Peñasquito Operations are situated in the western half of the Concepción Del Oro district in the northeast corner of Zacatecas State, Mexico, approximately 200 km northeast of the city of Zacatecas. The mine site is accessed via a turnoff from Highway 54 approximately 25 km south of Concepción Del Oro. There is an airport on site.

The climate is generally dry with precipitation being limited for the most part to a rainy season in the months of June and July. Mining operations are conducted year-round.

1.3 Mineral Tenure and Surface Rights

The Peñasquito Operations comprise 20 mining concessions (approximately 45,823 ha), held in the name of Minera Peñasquito. Concessions were granted for durations of 50 years. In the opinion of the responsible QP, information from legal experts and Goldcorp experts support that the mineral tenure held is valid and sufficient to support the disclosure of Mineral Resources and Mineral Reserves.

Surface rights in the vicinity of the Peñasco and Chile Colorado open pits are held by four ejidos: Ejido Cedros, Ejido Mazapil, Ejido El Vergel and Ejido Cerro Gordo, as well as certain private owners. Goldcorp has signed land use agreements with each of the ejidos, and the relevant private owners.

Hydrogeological studies are complete that show the aquifers in the Cedros Basin (the groundwater basin containing the Project) have enough available water to provide 40 Mm^3 per year. The Project has received permits to pump up to 35 Mm^3 of this water per year.

1.4 Agreements and Royalties

On 24 July 2007, Goldcorp and Wheaton Precious Metals Corp. (Wheaton PM), formerly Silver Wheaton Corp., entered into a transaction where Wheaton PM acquired 25% of the silver produced over the life-of mine (LOM) from the Peñasquito Project for an upfront cash payment of US$485 million. Wheaton PM pays Goldcorp a per-ounce cash payment of the lesser of US$3.90 and the prevailing market price (subject to an inflationary adjustment commencing in 2011), for silver delivered under the contract.

A 2% net smelter return (NSR) royalty is owed to Royal Gold Inc. (Royal Gold) on production from both the Chile Colorado and Peñasco locations. The Mexican Government levies a 7.5% mining royalty that is imposed on earnings before interest, taxes, depreciation, and amortization. There is also a 0.5% environmental erosion fee payable on precious metals production, based on gross revenues.

1.5 Environment, Permitting and Socio-Economics

The Peñasquito Operations currently hold all required permits to operate including environmental permits. Additional permitting is likely required in support of tailings storage requirements.

1.6 Geology and Mineralization

Deposits currently mined within the Peñasquito Operations are considered to be examples of breccia pipe deposits developed as a result of intrusion-related hydrothermal activity.

The regional geology of the operations area is dominated by Mesozoic sedimentary rocks, which are intruded by Tertiary stocks of intermediate composition (granodiorite and quartz monzonite) and overlain by Tertiary terrestrial sediments and Quaternary alluvium. The Mesozoic sedimentary rocks comprise a >2.5 km thick series of marine sediments deposited during the Jurassic and Cretaceous Periods with a 2,000 m thick sequence of carbonaceous and calcareous turbiditic siltstones and interbedded sandstones underlain by a 1,500 m to 2,000 m thick limestone sequence.

Large granodiorite stocks are interpreted to underlie large portions of the mineralized areas within the Concepción Del Oro District, including Peñasquito. Slightly younger quartz–feldspar porphyries, quartz monzonite porphyries, and other feldspar-phyric intrusions occurring as dikes, sills, and stocks cut the sedimentary units. The intrusions are interpreted to have been emplaced from the late Eocene to mid-Oligocene.

The two breccia pipes, Peñasco and Brecha Azul, are the principal hosts for gold–silver–zinc–lead mineralization at Peñasquito. The pipes flare upward and are filled with breccia clasts in a milled matrix of similar lithological composition. The larger diatreme, Peñasco, has a diameter of 900 m by 800 m immediately beneath surface alluvial cover. The second, and smaller, diatreme, Brecha Azul, is about 500 m in diameter immediately below alluvium. The diatremes are surrounded by coalesced halos of lower grade, disseminated sphalerite, galena, and sulphosalts containing silver and gold. The Chile Colorado deposit comprises mineralized sedimentary rocks adjacent to the Brecha Azul diatreme.

Both of the breccia pipes lie within a hydrothermal alteration shell consisting of a central sericite–pyrite–quartz (phyllic) alteration assemblage, surrounding sericite–pyrite–quartz–calcite assemblage, and a peripheral pyrite–calcite alteration halo.

Manto-style sulphide replacements of carbonate strata have been discovered beneath the clastic-hosted disseminated sulphide zones, and adjacent to the diatreme pipes. The mantos consist of semi-massive to massive sulphide replacements of sub-horizontal limestone beds, as well as cross-cutting chimney-style, steeply-dipping, fracture and breccia zones filled with high concentrations of sulphides.

Garnet skarn-hosted polymetallic mineralization has been identified at depth between the Peñasco and Brecha Azul diatremes. The skarn has horizontal dimensions of approximately 1,000 m by 1,200 m and is open at depth.

1.7 Exploration and History

Prior to Goldcorp's Project interest, the following companies either held an interest or performed exploration activities: Minera Kennecott SA de CV (Kennecott), Western Copper Holdings Ltd. (Western Copper), Western Silver Corporation (Western Silver), Mauricio Hochschild & Cia Ltda. (Hochschild) and Glamis Gold Corporation (Glamis).

Work undertaken included reconnaissance geological inspections, regional-scale geochemical and geophysical surveys (including gravity, controlled source audio frequency magnetollurics (CSAMT), reconnaissance induced polarization (RIP), scaler induced polarization (Scaler IP), airborne radiometrics and magnetics and ground magnetics), rotary air blast (RAB), reverse circulation (RC) and core drilling.

A pre-feasibility study was undertaken in 2004, a feasibility study in 2005 and a feasibility study update in 2006. Mine construction commenced in 2007. In October 2009, the first lead and zinc concentrates were produced and concentrate shipment to smelters commenced with first sales recorded in November 2009.

In the opinion of the responsible QP, the exploration programs completed to date are appropriate to the known mineralization style.

1.8 Drilling

Drilling completed on the Project for the period 1994 to 2018 comprised 1,774 drill holes (853,982 m). Drilling has focused on the exploration and delineation of three principal areas: the Chile Colorado Zone, the Brecha Azul Zone and the Peñasco Zone.

Drill hole spacing is generally on 50 m sections in the main deposits, with tighter spacing for infill drilling within the Peñasco pit. Drilling on 400 m spaced sections was undertaken in the condemnation zones and drill spacing is wider again in the areas outside the conceptual pit outlines used to constrain Mineral Resources. Drilling covers an area approximately 11 km east–west by 7 km north–south with the majority of drill holes concentrated in an area 2.1 km east–west by 2.8 km north–south.

Drill logs record deposit-specific information, including lithologies, breccia type, fracture frequency and orientation, oxidation, sulphide mineralization type and intensity, and alteration type and intensity. From mid-2013, logs have been recorded electronically and are uploaded directly to the Project database.

Prior to 2001, drill holes were located using chain-and-compass methods. From 2002 onwards, collar survey has been performed by a qualified surveyor. Since preparation for mining operations commenced in 2007, all surveys have been performed using differential global positioning system (DGPS) instruments.

Drill holes were down-hole surveyed using a single shot, through the bit, survey instrument. All drill holes have been down-hole surveyed except 51 Western Silver RC drill holes and 11 of the 71 Kennecott drill holes. Use of a gyroscopic survey instrument began in 2012 when Silver State Survey (SSS) was contracted. In the first 800 m of any drill hole, SSS takes a measurement at 50 m intervals and at the end of the drill hole.

Core recovery for the Peñasquito drilling programs averaged 98%.

Sample collection and handling of core was done in accordance with industry standard practices, with procedures to limit sample losses and sampling biases. RC drill cuttings were sampled at intervals of 2 m. The standard core sample interval is 2 m. Some samples are limited to geological boundaries and are less than 2 m in length.

The sampling has been undertaken over a sufficient area to determine deposit limits, and the data collected adequately reflects deposit dimensions, true widths of mineralization, and the style of the deposits. The samples are representative of the mineralization and respect the geology of the deposits.

In the opinion of the responsible QP, the quantity and quality of the lithological, geotechnical, collar, and down-hole survey data collected during the Goldcorp exploration and infill drill programs are sufficient to support Mineral Resource and Mineral Reserve estimation.

1.9 Sample Analysis and Security

Independent sample preparation and analytical laboratories used during the exploration, development and operational core drill programs on the Project include ALS Chemex, and Bondar Clegg (absorbed into ALS Chemex in 2001). The umpire (check) laboratories are Acme Laboratories in Vancouver, and SGS Mexico. Laboratories are certified, and independent of Goldcorp. The run-of-mine samples are assayed in an on-site mine laboratory that is not accredited.

The sample preparation method typically consists of drying, pulverizing and splitting to generate a 30 g pulp for assay. Prior to 2003, the pulverization standard was 85% passing 75 µm, after 2003, samples were pulverized to a minimum of 85% passing 200 mesh. Standard fire assay (FA) procedures are used for analysis of gold. Inductively-coupled plasma (ICP) analyses are used for silver, lead, zinc and deleterious elements.

Quality assurance and quality control (QA/QC) measures for Goldcorp programs include submission of standard reference materials and blanks, and re-assay of a proportion of the samples.

In the opinion of the responsible QP, the quality of the analytical data is sufficiently reliable to support Mineral Resource and Mineral Reserve estimation and that sample preparation, analysis, and security are generally performed in accordance with exploration best practices and industry standards.

1.10 Data Verification

A number of data verification programs and audits have been performed over the Project's history by independent consultants in support of technical reports and by Goldcorp personnel in support of mining studies. Data verification checks were performed as follows:

- SNC Lavalin (2003): independent review of sampling and assay data on the Project, review of 10% of database; no material biases or errors noted; selection of six samples from the core library for independent analysis;
- Independent Mining Consultants (2005): independent database review in support of feasibility study; no material biases or errors noted;
- Mine Development Associates (2007): independent analytical review of the Peñasquito check assay data; concluded that the analytical work performed on gold, silver, lead and zinc assays in the Peñasquito database could be relied upon for resource estimation;
- Hamilton (2014): independent verification of assay data quality through review of QA/QC procedures and results; no significant issues identified; and
- Goldcorp (2006 to date): database validation checks; checks on historical (pre-Goldcorp) data; no material biases or errors noted.

A reasonable level of verification has been completed, and no material issues would have been left unidentified from the programs undertaken. Data verification programs completed on the data collected from the Project adequately support the geological interpretations, and the quality of the analyses and the analytical database, and therefore support the use of the data in Mineral Resource and Mineral Reserve estimation.

1.11 Metallurgical Testwork

Metallurgical testwork has focused on recovery of the key elements, lead and zinc, with co-recovery of gold and silver.

Various testwork programs have investigated comminution, flotation, heavy media separation, gravity concentration, flowsheet variability schemes, concentrate filtration, dewatering, and regrind tests, modal and liberation analyses, and bottle roll and column cyanide leach extraction tests. In addition, testwork was recently carried out to evaluate several metallurgical alternatives to recover precious metals from carbon pre-flotation concentrates, in particular ultrafine gravity concentration.

The testwork programs were performed to establish the optimal processing routes for oxide and sulphide ores, and to support estimation of recovery factors for the various ore types. A number of ore types have been identified that are classed due to their specific chemical characteristics, and in the past have included transitional, low-lead, high-copper and high-carbon types. The new Pyrite Leach Project has also investigated the metallurgical responses to treatment for additional gold and silver recovery from the zinc flotation tailings.

Over the life of mine gold and silver recovery from the oxide heap leach has stabilised. Recovery from the heap leach is currently forecasted at about 59.0% for gold and 25.5% for silver in the life-of-mine (LOM) plan (LOMP).

The mineralogical complexity of the Peñasquito ore makes the development of mill models difficult as eight elements (gold, silver, lead, zinc, copper, iron, arsenic and antimony) are tracked through the process, and the models need to be robust enough to allow for changes in mineralogy and plant operations while giving reasonable predictions of concentrate quality and tonnage. Based on the updated 2017 metallurgical recovery models, the forecasted LOM average recoveries prior to the start-up of the Pyrite Leach Project (PLP) are:

- Gold: 59.5%
- Silver: 78.6%
- Lead: 75.0%
- Zinc: 79.1%

Following the completion of the PLP, the forecasted LOM average recoveries are:

- Gold: 72.3%
- Silver: 87.6%
- Lead: 75.0%
- Zinc: 79.1%

Updates to the recovery models were made in 2017, to incorporate the impact of organic carbon on all ore types. The models incorporate new additions to the process plant, namely the Carbon Pre-Flotation Process (CPP), PLP, and the Tertiary Precious Metals Recovery Project. All stated recoveries exhibit short-term variability, for all ore types, around the stated life of mine average recoveries.

Metallurgical testing on processing methods that will allow the processing of high carbon ores and the recovery of gold-rich pyrite in the tailings have been performed. Testing results have demonstrated that both options are feasible, and the carbon pre-flotation plant was recently constructed while the pyrite flotation and leaching plant are under construction.

1.12 Mineral Resource Estimate

Sets of three-dimensional (3D) solid wire-frames (solids) were created for lithology, alteration, oxidation states, organic carbon and mineralized faults. Grade shell domains were created to aid the interpolation of gold, silver, lead, zinc and copper. A block size of 15 m x 15 m x 15 m was used for estimation of mineral resources. The model is not rotated.

The penalty elements antimony, arsenic and copper, together with iron and sulphur (used to track oxidation) were interpolated into the same block model as the primary economic metals gold, silver, lead and zinc. Grade caps were applied to raw assay data prior to compositing. The selected cut-off varied by a combination of lithology and north–south domain and was selected at around the 99th to 99.9th percentile for all interpolated metals.

Composites were created down each hole at 5 m intervals. In the models which use grade domains, composites were made honouring grade-domain contacts, that is, composites end at each grade-domain contact, and start again after it. In the other models, composites start at the top of the first interval with assays and continue to the end of the hole, irrespective of the lithology. Composites <2 m in length were discarded.

Multi-directional variograms (correlograms) were developed for gold, silver, lead and zinc for each solid to determine grade continuity of these elements. The spatial continuity of the deleterious element grades was also modeled using correlograms.

Density values in the block models were assigned based on density mean measurements.

For the resource model, interpolation domains comprise a combination of the lithology, alteration, and fault domains, together with the grade shells as appropriate. Validation of the models indicated that they were appropriately constructed and reflected the geological interpretations and grade continuity of the deposits.

The Mineral Resources were classified into Measured, Indicated, and Inferred Mineral Resource categories for the resource model, based on the number of drill holes informing a block and within a given search distance for each category.

Mineral Resources that could be extracted using open pit mining methods were assessed for reasonable prospects of economic extraction by confining the mineralization within a Lerchs-Grossmann (LG) optimized pit shell.

Mineral Resources are reported using a gold price of US$1,400.00/oz, a silver price of US$20.00/oz, a lead price of US$1.00/lb and a zinc price of US$1.10/lb. Open pit Mineral Resources are reported using the same cut-off methodology that is used for Mineral Reserves. The cut-off is based on generating positive net smelter return on a block-by-block basis after applying all revenue and associated costs. The incremental cost used for milled ore is US$11.90/t, and for leach ore is US$4.90/t, and includes all mill operating, administrative and sustaining capital costs. Other factors considered are product freight to market costs, smelter costs (including penalties) and royalties.

Mineral Resources take into account geological, mining, processing and economic constraints, and have been confined within geological boundaries; they can therefore be classified in accordance with the 2014 CIM Definition Standards for Mineral Resources and Mineral Reserves (2014 CIM Definition Standards). The QP for the Mineral Resource estimate is Dr. Guillermo Pareja, an employee of Goldcorp. The Mineral Resource estimate has an effective date of 30 June 2017.

The Mineral Resource estimate is reported exclusive of Mineral Reserves and is summarized in Table 1-1.

Table 1.1: Mineral Resource Estimate

Process Route	Category	Tonnes (Mt)	Grade				Contained Metal			
			Gold (g/t)	Silver (g/t)	Lead (%)	Zinc (%)	Gold (Moz)	Silver (Moz)	Lead (Mlb)	Zinc (Mlb)
Mill	Measured	117.47	0.29	29.1	0.26	0.57	1.10	109.97	677.80	1,469.52
	Indicated	132.93	0.25	25.0	0.20	0.47	1.09	106.85	592.71	1,388.60
	Measured + Indicated	*250.40*	*0.27*	*26.9*	*0.23*	*0.52*	*2.18*	*216.82*	*1,270.51*	*2,858.13*
	Inferred	23.53	0.29	18.8	0.16	0.59	0.22	14.21	85.21	306.74
Heap Leach	Measured	8.59	0.21	29.1	-	-	0.06	8.05	-	-
	Indicated	16.33	0.21	24.1	-	-	0.11	12.66	-	-
	Measured + Indicated	*24.92*	*0.21*	*25.9*	-	-	*0.17*	*20.71*	-	-
	Inferred	0.14	0.21	8.9	-	-	0.0	0.04	-	-

Notes to accompany Mineral Resource Table:

1. Dr. Guillermo Pareja, P.Geo., a Goldcorp employee, is the Qualified Person for the estimate. The estimate has an effective date of 30 June 2017.
2. Mineral Resources are classified as Measured, Indicated and Inferred Mineral Resources, and are based on the 2014 CIM Definition Standards.
3. Mineral Resources are exclusive of Mineral Reserves.
4. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability.
5. Based on US$ commodity prices of $1,400 per ounce gold, $20.00 per ounce silver, $1.00 per pound lead and $1.10 per pound of zinc
6. Mineral Resources were assessed for reasonable prospects of eventual economic extraction by confining the mineralization within an optimized pit shell.
7. The resource block model includes internal and contact dilution.
8. The estimated metallurgical recovery rate for the Peñasquito Mill is assumed similar to Mineral Reserves.
9. Cut-off determination methodology is similar to Mineral Reserves, except metal pricing as noted.
10. Tonnages are rounded to the nearest 10,000 tonnes; grades are rounded to two decimal places except for silver which is one decimal place.
11. Rounding as required by reporting guidelines may result in apparent summation differences between tonnes, grade and contained metal content.
12. Tonnage and grade measurements are in metric units. Contained gold and silver ounces are reported as troy ounces. Contained lead and zinc pounds are Imperial pound units.

Risk factors that can affect the Mineral Resource estimates are: metal prices and exchange rate assumptions; assumptions which are used in the LG shell constraining Mineral Resources, including mining, processing and general and administrative (G&A) costs; metal recoveries; geotechnical and hydrogeological assumptions; and assumptions that the operation will maintain the social licence to operate.

1.13 Mineral Reserve Estimate

The Mineral Reserve estimate for the operations is based on Measured and Indicated Mineral Resources. A four-step process is used to estimate the Mineral Reserves:

- The Peñasquito contained metal block model is interpolated with a series of software scripts in which an NSR value is calculated for each block, based on recovery and marketing assumptions;
- The Peñasquito NSR block model then undergoes a process of "pit optimization" where Whittle mine planning software optimizes the potential future financial return for a number of intermediate pit shells and defines the ultimate pit size and shape for each of the two deposits. The ultimate pit shell offering the best economic results is selected, based on the defined parameters while respecting geotechnical limitations;
- With the ultimate pit limits defined, practical design parameters are completed within a mine design software package. This process results in a series of minable cutbacks that together form the ultimate pit design for the deposit;
- A series of potential production schedules are produced that are based on the practical sequencing of each cut-back, the mining equipment available, and operational limitations such as production rates, haulage distance, mill throughput capacity etc. From this process, which in most cases is iterative, a practical LOM production schedule is developed that tries to maximize the metal production and minimize operating and capital costs and defines the annual mining, milling and metal production schedules.

The current mine plan is based on the 2017 Mineral Reserve estimate and will produce oxide and sulphide material to be processed through the existing heap leach facility and sulphide plant respectively over a 12-year LOM (2018–2029).

Open pit Mineral Reserves were estimated using metal prices of US$1,200.00/oz for gold, a silver price of US$18.00/oz, a lead price of US$0.90/lb and a zinc price of US$1.05/lb. An exchange rate of 16.25 Mexican pesos to the US dollar was used. The average life of mine mining cost used to support the estimate is US$1.94/t mined; the total incremental operating costs used for milling cut-off prior to the pyrite leach is US$8.00/t milled and the total incremental operating costs used for milling cut-off including pyrite leach is US$11.90/t milled.

Dilution is accounted for in block models by ensuring the models have the appropriate change of support to produce a grade–tonnage curve that reflects the expected mining selectivity. Block models also incorporate anticipated contact dilution through the interpolation plan that utilizes both mineralization and waste samples at the ore/waste boundary within a given interpolation domain. Because the same models are used for both Mineral Reserves and Mineral Resources, dilution is incorporated in both estimates. Mineral Reserves and Mineral Resources are reported at 100% of the block model.

Dilution studies are ongoing and dilution correction factors based on mine to mill reconciliation are periodically updated.

Mineral Reserves have been classified using 2014 CIM Definition Standards. The Qualified Person for the estimate is Mr. Victor Vdovin, P.Eng., a Goldcorp employee. The Mineral Reserve estimate has an effective date of 30 June 2017 and is summarized in Table 1-2.

Key risk and opportunity factors that can affect the Mineral Reserve estimates for the Peñasquito Operations include: metal prices and exchange rate assumptions; mining, process, operating and capital cost assumptions; availability of water sufficient to support the mine design and process plant throughput rate assumptions; deleterious substances in mineralization that may affect metallurgical recovery rate; social licence to operate being maintained; and any additional modifications or proposed changes to the projected taxation and royalty regimes.

To support declaration of Mineral Reserves, Goldcorp prepares an economic analysis to confirm that the economics based on the Mineral Reserves over the mine life repays life-of-mine operating and capital costs. The mine was evaluated on an after-tax free cash flow basis.

Table 1.2: Mineral Reserve Estimate

Process Route	Category	Tonnes (Mt)	Grade				Contained Metal			
			Gold (g/t)	Silver (g/t)	Lead (%)	Zinc (%)	Gold (Moz)	Silver (Moz)	Lead (Mlb)	Zinc (Mlb)
Mill	Proven	352.66	0.59	35.4	0.35	0.75	6.70	400.97	2,697.06	5,868.13
	Probable	162.37	0.41	26.4	0.24	0.51	2.13	137.86	826.95	1,842.24
	Proven + Probable	***515.03***	***0.53***	***32.5***	***0.31***	***0.68***	***8.83***	***538.83***	***3,560.00***	***7,710.38***
Heap Leach	Proven	8.52	0.38	22.6	-	-	0.10	6.19	-	-
	Probable	1.20	0.24	13.9	-	-	0.01	0.54	-	-
	Proven + Probable	***9.72***	***0.36***	***21.5***	-	-	***0.11***	***6.73***	-	-

Notes to accompany Mineral Reserve Table:

1. Mr. Victor Vdovin, P.Eng., a Goldcorp employee, is the Qualified Person for the estimate. The estimate has an effective date of 30 June 2017.
2. The Mineral Reserves are classified as Proven and Probable Mineral Reserves and are based on the 2014 CIM Definition Standards.
3. Based on a gold price of $1,200 per ounce, a silver price of $18.00 per ounce, a lead price of $0.90 per pound and a zinc price of $1.05 per pound; and an economic function that includes variable operating costs and metallurgical recoveries.
4. Prior to the pyrite leach circuit, the estimated recovery rate for the Peñasquito Mine (“Mill”) averages 60.5% for gold, 78.9% for silver, 75.2% for lead and 79.3% for zinc. After the pyrite leach circuit, the estimated recovery rate for the Peñasquito Mine (“Mill”) averages 72.3% for gold and 87.2% for silver, with other metal recoveries unchanged. A pyrite leach gold recovery circuit is assumed to be operational late 2018. Recovery relationships of the ore types are very complex and can vary considerably from these averages.
5. The estimated metallurgical recovery rate for the Peñasquito Mine (“Heap Leach”) is 59.0% for gold and 25.5% for silver.
6. Cut-off is based on generating positive net smelter return on a block-by-block basis applying all revenue and associated costs. The average life of mine mining cost used to support the estimate is US$1.94/t mined. The total incremental operating costs used for milling cut-off prior to the pyrite leach is US$8.00/t milled and the total incremental operating costs used for milling cut-off including pyrite leach is US$11.90/t milled., Leach ore is US$4.90 per tonne, and includes all mill operating, administrative and sustaining capital costs. Other factors considered are product freight to market costs, smelter costs (including penalties) and royalties.
7. A forward sales contract for 25% of silver production exists with Wheaton PM.
8. Tonnages are rounded to the nearest 10,000 tonnes; grades are rounded to two decimal places, except for silver, which is one decimal place.
9. Rounding as required by reporting guidelines may result in apparent differences between tonnes, grade and contained metal content.
10. Tonnage and grade measurements are in metric units. Contained gold and silver ounces are reported as troy ounces. Contained lead and zinc pounds are Imperial pound units.

1.14 Mine Plan

Open pit designs use defined geotechnical domains together with rock mass quality ratings for the principal lithologies and appropriate pit design criteria that reflect expected conditions and risk. Geotechnical studies were completed by external consultants and Goldcorp operations staff.

A combination of Goldcorp staff and external consultancies have developed the pit water management program, completed surface water studies, and estimated the life-of-mine site water balance. Management of water inflows to date have been appropriate, and no hydrological issues that could impact mining operations have been encountered. Water levels are maintained at least 30 m below the active mining elevation (bench) to ensure efficient production and safe access.

The final open pit will have one contiguous outline at surface but will consist of two distinct pit bottoms, one on the Peñasco Zone and one on the Chile Colorado (Brecha Azul) Zone.

The open pit operations will progress at a nominal annual mining rate of 200 Mt/a until the end of 2020, subsequently decreasing to a nominal mining rate of 173 Mt/a until the end of 2023. The LOM plan assumes a nominal rate of 41 Mt/a milling throughput until the end of 2028 and the fourth quarter of 2029, and the heap leach pad will be stacked with incremental oxide ore as it is mined.

An ore stockpiling strategy is practiced. The mine plan considers the value of the blocks mined on a continuous basis combined with the expected concentrates quality. From time to time ore material with a lower NSR value will be stockpiled to bring forward the processing of higher-value ore earlier in the LOM. In some instances, the ore is segregated into stockpiles of known composition to allow for blending known quantities of material at the stockpile as required by the mill/customer. Stockpiling at Peñasquito also allows for forward planning for ore quality to ensure optimal mill performance and consistent gold production to match, within the normal bounds of expected variability within the mine plan.

Open pit mining is undertaken using a conventional truck-and-shovel fleet, currently consisting of seventy-eight haul trucks, five rope shovels, two hydraulic shovels and four loaders. The fleet is supported by twelve blast hole productions drills, track dozers, rubber tire dozers, excavators, and graders; the mining fleet is owner-operated. Maintenance of mine equipment is covered by MARC contracts with current strategy to move towards owner-based maintenance. The current loading capacity of the mining fleet is sufficient for the current 12-year LOM; however, additional haul trucks will need to be added to the fleet over the next several years as the haulage profiles continue to increase with greater pit depths and distance to the waste dumps.

As part of day-to-day operations, Goldcorp will continue to undertake reviews of the mine plan and consideration of alternatives to and variations within the plan. Alternative scenarios and reviews may be based on ongoing or future mining considerations, evaluation of different potential input factors and assumptions, and corporate directives.

1.15 Process Plant

The Peñasquito Operations consist of a heap leach gold and silver recovery facility that can process a nominal 25,000 t/d of oxide ore and a sulphide plant that processes a nominal 124,000 t/d of sulphide ore.

Leach pad run-of-mine (ROM) oxide ore is delivered to the heap leach pile from the mine by haul trucks. Lime is added to the ore, prior to addition of the ore to the pad. Ore is placed in 10 m lifts and leached with cyanide solution. Pregnant leach solution is clarified, filtered, and de-aerated, then treated with zinc dust to precipitate the precious metals. The barren solution is recycled for re-use in the heap leach circuit. The precipitated metals are subsequently pressure filtered, and the filter cake smelted to produce doré.

Sulphide ROM ore is delivered to the crusher dump pocket from the mine. The crushing circuit is designed to process up to 148,000 t/d of ROM ore to a crush size of 80% passing (P_{80} value) of 159 mm size. The crusher feeds, via an apron feeder, a coarse ore stockpile. In turn, nine apron feeders reclaim ore from the coarse ore stockpile to two semi-autogenous grind (SAG) mills operating in closed circuit with pebble crushers, ball mills, and a cyclone classification system. Each grinding circuit reduces the crushed ore from P_{80} passing 159 mm to a P_{80} passing 125 µm. The pebble crushers are set to produce a P_{80} crush size of 28 mm. The crusher product is conveyed back to a 1,400 t storage bin from which the discharge is directed to the high pressure grind rolls (HGPR) unit.

A secondary cone (augmented feed) crusher is fed directly with coarse ore stockpile material by a single apron feeder and the product is dry screened. The oversize from the augmented feed crusher screen together with the oversize from the SAG trommel screens constitutes the feed to the pebble cone crushers.

The HPGR is operated in open circuit, and along with material from the coarse ore stockpile is feed to the two SAG mills. Secondary grinding is performed in four ball mills. Ball mill discharge is combined with SAG mill trommel screen undersize and the combined slurry is pumped to the primary classification cyclone clusters.

Cyclone overflow (final grinding circuit product) flows by gravity to the new carbon pre-flotation circuit or to the lead flotation circuit. The carbon pre-flotation circuit consists of two parallel banks of rougher flotation cells, a single cleaner-scavenger flotation bank, and a re-cleaner column flotation cell. The re-cleaner column carbon concentrate reports to final tailings or to the future tertiary metal recovery process that is currently under construction. The overall tailings from the carbon pre-flotation circuit are pumped back to become feed to the lead flotation circuit.

The lead rougher flotation consists of six rows of rougher flotation machines in parallel. Lead rougher concentrate is pumped to the lead regrind mill circuit or bypassed directly to the lead cleaner conditioning tank. Tailings from each line of lead rougher cells flow by gravity to the respective zinc rougher conditioner tanks. Rougher lead concentrate is reground using a vertical mill in closed circuit with cyclones. Product at a P_{80} size of 30–40 µm is upgraded in a three-stage cleaner flotation circuit.

The zinc conditioners overflow to the zinc rougher flotation circuit, which consists of six banks of six rougher flotation cells. The rougher zinc concentrate is reground in vertical mills operating in closed circuit with cyclones. Product at a P_{80} size of 30–40 µm is also cleaned in a three-stage cleaning circuit.

Final product lead and zinc concentrates are thickened, pressure filtered and trucked to inland smelters or to ports for overseas shipment.

The PLP, which is currently under construction will incorporate rougher flotation of a pyrite concentrate from the zinc tails. The pyrite rougher concentrate will undergo pre-cleaner regrind, cleaner flotation, post-cleaner regrind, pre-leach flotation ahead of cyanidation and recovery of gold and silver via the Merrill-Crowe process.

1.16 Infrastructure

Site infrastructure comprises:

- Two active open pits;
- Four active waste rock dumps (with conveying and stacking system for the near pit sizer-convey (NPSC) waste dump);
- One concentrator plant and associated conveying systems;
- One heap leach pad and Merrill Crowe plant;
- Camp / accommodation complex;
- Maintenance, administration and warehouse facilities;
- Tailings storage facility (TSF);
- Medical clinic;
- Various ancillary buildings;
- Paved airstrip;
- Diversion channels;
- Pipelines and pumping systems for water and tailings;
- Access roads;

- Explosive storage facilities;
- High-voltage transmission line;
- Environmental monitoring facilities.

1.17 Markets and Contracts

Goldcorp currently has an operative refining agreement with Met Mex Peñoles for refining of doré produced from the operations. Goldcorp's bullion is sold on the spot market, by marketing experts retained in-house by Goldcorp. The terms contained within the sales contracts are typical and consistent with standard industry practice and are similar to contracts for the supply of doré elsewhere in the world. Part of the silver production is forward-sold to Wheaton PM.

Goldcorp has entered into forward sales agreements for the base metals volumes in relation to Peñasquito concentrate sales.

1.18 Capital and Operating Cost Estimates

All capital expended prior to 1 January 2018 will be considered as initial project capital ("sunk" capital), either spent or committed to be spent, and so was not included in the economic evaluation. Exploration expenditures were not included in the financial analysis. Exploration drilling will be performed in the future to target mineralization that may lead to an increase in Mineral Resources. Because these future exploration drilling expenditures do not pertain to the current Mineral Reserves, they were not included in the financial model.

Capital costs are based on forecasts based on the 2018 LOM, covering expenditures for calendar years 2018 through 2029. Capital cost estimates include funding for infrastructure, mobile equipment, development and permitting, and miscellaneous costs. Infrastructure requirements were incorporated into the estimates as needed. Sustaining capital costs reflect current price trends.

As with all capital projects, Board of Director approval is required on an annualized basis. The Mineral Reserve and LOM plan in this Report assume that PLP will be operational in 2018.

The sustaining and expansionary capital cost estimates are included as Table 1-3.

Operating costs were estimated by Goldcorp personnel, and are based on an estimate effective 30 June 2018 to support LOM budgeting.

The operating cost estimate over the LOM is presented in Table 1-4 and includes allocations for processing and overhead costs.

Table 1.3: Capital Cost Estimate

Area	Life-of-Mine (US$ million)
Mine Pre-Stripping	$ 818.30
General Sustaining	$ 1,087.79
Growth	$ 191.75
Total	***$2,097.84***

Note: Totals may not sum due to rounding.

Table 1.4: Operating Cost Estimate

Area	Life-of-Mine (US$/t)
Process Plant (with Pyrite Leach)	$ 9.09/t milled
Process Plant (without Pyrite Leach)	$ 7.46/t milled
General & Administration	$ 1.88/t milled
Mining	$1.87/t of material mined

1.19 Financial Analysis

Goldcorp is using the provision for producing issuers, whereby producing issuers may exclude the information required under Item 22 for technical reports on properties currently in production and no material expansion of current production is planned.

Mineral Reserve declaration is supported by a positive cashflow.

1.20 Interpretation and Conclusions

Under the assumptions in this Report, the Peñasquito Operations show a positive cash flow over the LOM and support Mineral Reserves. The mine plan is achievable under the set of assumptions and parameters used.

1.21 Recommendations

In 2018, drilling will focus on supporting estimation of Indicated Mineral Resources, delineating extensions to high-grade zones within the deposits, and defining additional mineralization that could potentially support resource estimation within the Peñasquito Operations area. The 2019 drilling program budget is estimated at US$10.5 million; similar expenditures are anticipated for the subsequent three years.

The current TSF has been designed to feasibility level and permitted to 1,908 m elevation. Concept studies were completed during 2017 that indicated that the current facility can be safely raised to 1,922 m elevation, adequate to store all LOM tonnage as indicated in June 30, 2017 Mineral Reserve statement. The engineering costs are expected to be $22M, which were included in budget. Based on the results of those studies, additional optimization to Centerline Raise may be done in the future in order to reduce construction costs and optimize factors of safety.

Once sufficient data from the new process modifications is available (CPP and PLP) on all ore types, efforts should be made to revisit the metallurgical recovery models in keeping with good practice. To support continued process optimization, further geometallurgical variability testing on future ores is necessary to better understand recovery and operating cost variability (approximate cost US$1.5 million).

2.0 INTRODUCTION

2.1 Introduction

Mr. Victor Vdovin P.Eng., Dr. Guillermo Pareja, P.Geo., Mr. Peter Lind, P.Eng (the Qualified Persons or QPs) prepared this Technical Report (the Report) for Goldcorp Inc. (Goldcorp) on the wholly-owned Peñasquito Polymetallic Operations (the Peñasquito Operations or the Project) located in the state of Zacatecas, Mexico.

The Peñasquito Operations contain the Peñasco and Chile Colorado (Brecha Azul) deposits. Open pit mining commenced in 2010, and commercial production was reached during 2011. The open pit feeds a sulphide concentrator (mill) and a heap leach pad.

2.2 Terms of Reference

This Report is being filed in support of Goldcorp's Short Form Base Shelf Prospectus and its public disclosure relating to the Peñasquito Operations.

The operating entity is a Goldcorp subsidiary, Minera Peñasquito, S.A. de C.V. (Minera Peñasquito). Mineral tenure is held in the name of Minera Peñasquito, an indirectly wholly-owned Goldcorp subsidiary. For the purposes of this report, "Goldcorp" is used to refer interchangeably to the parent and the subsidiary company.

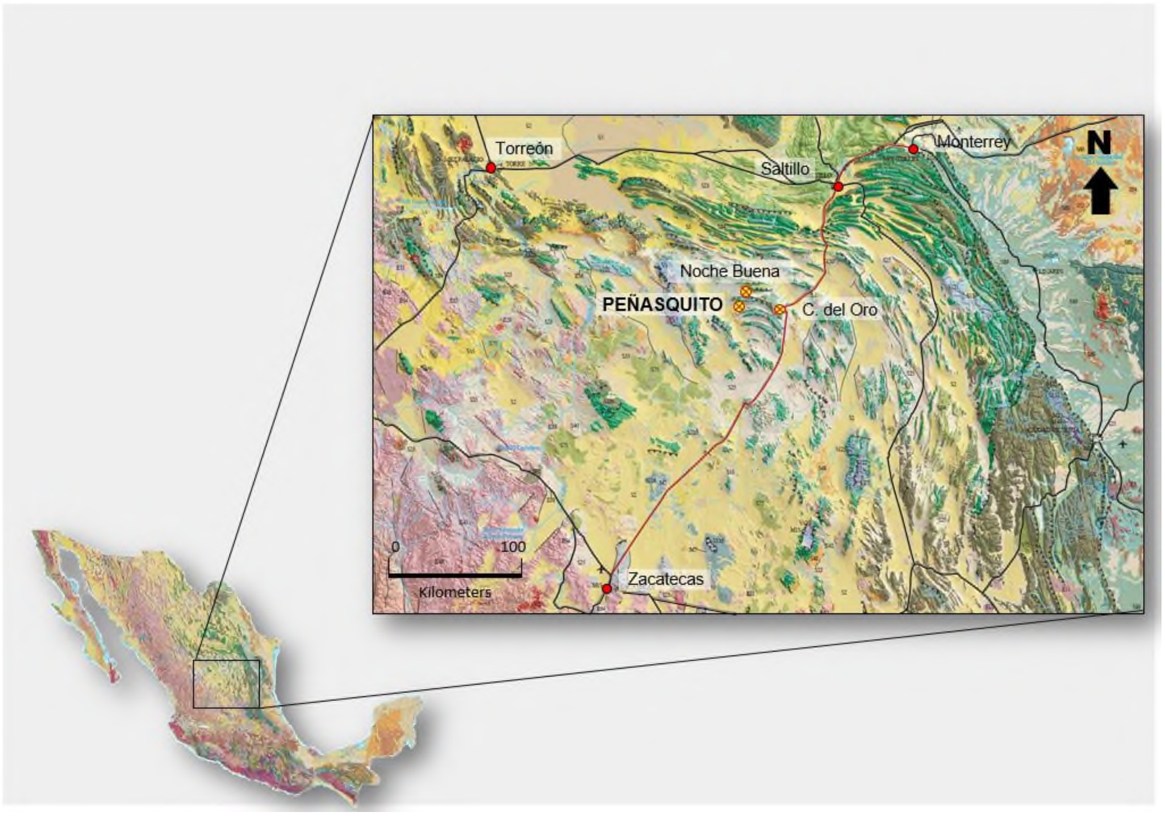
All measurement units used in this Report are metric unless otherwise noted, and currency is expressed in US dollars (US$).

2.3 Qualified Persons

This Report has been prepared by the following QPs:

- Mr. Victor Vdovin, P.Eng., Mining Manager, Peñasquito Mine, Goldcorp;
- Dr. Guillermo Pareja, P.Geo., Manager, Mineral Resources, Goldcorp; and
- Mr. Peter Lind, P.Eng., Director, Metallurgy Projects, Goldcorp.

Figure 2.1: Project Location Map



Note: Figure prepared by Goldcorp, 2017

2.4 Site Visits and Scope of Personal Inspection

Each QPs is a Goldcorp employee, based in either the Goldcorp corporate office in Vancouver or at the Peñasquito Operations, and the scope of personal inspection is detailed below:

- Mr. Victor Vdovin is an employee of Goldcorp, based at the Peñasquito Operations, and works at the Project operations; this familiarity with the Project constitutes the personal inspection requirement. Mr. Vdovin has worked with Goldcorp since February 2015. In his site-based role first as Technical Services Manager since November 2016, and currently as Mining Manager since January 2018, he has had overall responsibility for the engineering activities at the Project site including mine planning, rock mechanics, and survey. Mr. Vdovin has visited the open pit workings and inspected active mining faces, viewed site infrastructure including dewatering and water treatment, power distribution, waste dumps, and process and tailings infrastructure. He was directly responsible for mine modeling, mine planning and Mineral Resource and Mineral Reserve estimations. He has held discussions with site personnel on aspects of exploration, mine operations, infrastructure, plant operations, metallurgy, financial planning and budgeting, environmental and permitting considerations and social considerations.

- Dr. Guillermo Pareja has been travelling to the Peñasquito Operations at least once a year since 2009. The dates of the most recent site visits are 17-31 October 2016, 12-26 September 2016, 08-18 August 2016, 12-14 July 2016 and 15–19 February 2016. During these visits, Dr. Pareja has inspected drill core; visited logging areas; discussed geology and mineralization with the staff; reviewed geological interpretations with staff; and reviewed on-site data compilation.
- Mr. Peter Lind visited the Peñasquito Operations from 7 -12 May 2018. Previously he visited from 4-10 July 2017, 5-7 June 2017, and 13-16 February 2017. During the site visit, Mr. Lind visited the process plant, mining operations and core storage area. He discussed on-going testwork, pilot programs, and process changes with the plant metallurgical personnel.

2.5 Effective Dates

The Report has several effective dates:

- The close-out date for the drill data that supports resource estimation, 26 February 2017;
- The effective date of the Mineral Resource Estimate, 30 June 2017;
- The effective date of the Mineral Reserve Estimate, 30 June 2017.

The overall effective date of this Report, and the cut-off date for scientific and technical information used to update this Report, is 30 June 2018.

2.6 Information Sources and References

This Report is based in part on internal company reports, maps, published government reports, and public information, as listed in Section 27 of this Report. Specialist input from Goldcorp employees in other disciplines, including legal, process, geology, geotechnical, hydrological and financial, was sought to support the preparation of the Report. Information used to support this Report is also derived from previous technical reports on the property.

All figures were prepared by Goldcorp personnel for the Report unless otherwise noted.

2.7 Previous Technical Reports

Goldcorp has previously filed the following technical reports for the Project:

- Redmond, D., Goodman, S., Pareja, G., De Ruijter, 2015: Peñasquito Pollymetallic Operations, Zacatecas State, México, NI 43-101 Technical Report: NI 43-101 technical report prepared for Goldcorp, effective date 31 December 2015;
- Belanger, M., and Pareja, G., 2014: Peñasquito Polymetallic Operation Zacatecas State Mexico, NI 43-101 Technical Report: NI 43-101 technical report prepared for Goldcorp, effective date 8 January 2014;
- Belanger, M., Pareja, G., Chen, E. and Nahan, P., 2011: Peñasquito Polymetallic Operation, Zacatecas State, Mexico, NI 43-101 Technical Report: NI 43-101 technical report prepared for Goldcorp, effective date 31 December 2011;
- Bryson, R.H., Brown, F.H., Rivera, R., and Butcher, M.G., 2009: Peñasquito Project Technical Report, Concepción del Oro District, Zacatecas State, México: NI 43-101 technical report prepared for Goldcorp, effective date 10 March 2009;
- Bryson, R.H., Brown, F.H., Rivera, R., and Ristorcelli, S., 2007: Peñasquito Project Technical Report, Concepción del Oro District, Zacatecas State, México: NI 43-101 technical report prepared for Goldcorp, effective date 31 December 2007.

Goldcorp acquired Glamis Gold Inc. (Glamis) in 2006. Prior to the acquisition, Glamis had filed the following technical reports for the Project:

- Voorhees J.S., Hanks, J.T., Drielick, T.L., Wythes, T.J., Huss, C.E., Pegnam, M.L., and Johnson, J.M., 2008: Peñasquito Feasibility Study, 100,000 Mtpd, NI 43-101 Technical Report: NI 43-101 technical report prepared by M3 Engineering and Technology Corp. for Glamis Gold Inc., effective date 31 July 2006.

Glamis acquired Western Silver Corporation (Western Silver) in 2006. Prior to the acquisition, Western Silver had filed the following technical reports for the Project:

- Marek, J., Hanks, J.T., Wythes, T.J., Huss, C.E., and Pegnam, M.L., 2005: Peñasquito Feasibility Study Volume I NI 43-101 Technical Report: NI 43-101 technical report prepared by M3 Engineering and Technology Corp. for Western Silver Corporation, November 2005;
- Independent Mining Consultants, 2005: Executive Summary of the Technical Report Preliminary Resource Estimate Update for the Peñasco Deposit, Peñasquito Project State of Zacatecas, Mexico: NI 43-101 technical report prepared by Independent Mining Consultants for Western Silver Corporation, April 2005;
- M3 Engineering and Technology Corp., 2004: Western Silver Corporation, Peñasquito Pre-Feasibility Study: NI 43-101 technical report prepared by Independent Mining

Consultants for Western Silver Corporation, April 2004; amended and restated 8 November 2004, further amended and restated 10 December 2004;

- Marlow, J., 2004: Technical Report, Preliminary Resource Estimate, for the Peñasco Deposit Peñasquito Project State of Zacatecas, Mexico: NI 43-101 technical report prepared for Western Silver Corporation, effective date 3 November 2004;
- SNC Lavalin, 2004: Minera Peñasquito, S.A. De C.V., Peñasquito Project, Mineral Resource Estimate for Chile Colorado Zone: NI 43-101 technical report prepared by SNC Lavalin for Western Silver Corporation, March 2004;
- Ashby, Z., and Hanson, W.C., 2003: Minera Peñasquito, S.A. De C.V., Preliminary Mineral Resource Estimate: NI 43-101 technical report prepared by SNC Lavalin for Western Silver Corporation, March 2003.

3.0 RELIANCE ON OTHER EXPERTS

This section is not relevant to the Report as information on areas outside the QPs' experience was sourced from Goldcorp experts as noted in Section 2.6.

4.0 PROPERTY DESCRIPTION AND LOCATION

The Peñasquito Operations are situated in the western half of the Concepción Del Oro district in the northeast corner of Zacatecas State, Mexico, approximately 200 km northeast of the city of Zacatecas. Project centroid co-ordinates are approximately 24°45'N latitude/101° 30'W longitude.

4.1 Project Ownership

The Project is indirectly 100% held by Goldcorp. Goldcorp uses an indirectly 100% owned subsidiary, Minera Peñasquito SA de C.V. (Minera Peñasquito), as the operating entity for the mine.

4.2 Mineral Tenure

As of 30 June 2018, Minera Peñasquito held 20 mining concessions (45,823.0770 ha). Claims are summarized in Table 4-1, and the claim locations are shown in Figure 4-1.

Currently all tenure is held in the name of Minera Peñasquito.

As per Mexican requirements for grant of tenure, the concessions comprising the Project have been surveyed on the ground by a licensed surveyor. Duty payments for the concessions have been made as required.

Concessions were granted for durations of 50 years and a second 50-year term can be granted if the applicant has abided by all appropriate regulations and makes the application within five years prior to the expiration date. Obligations which arise from the mining concessions include performance of assessment work, payment of mining taxes and compliance with environmental laws. Duty payments for the concessions have been made as required. Minimum expenditures, pursuant to Mexican regulations, may be substituted for sales of minerals from the mine for an equivalent amount.

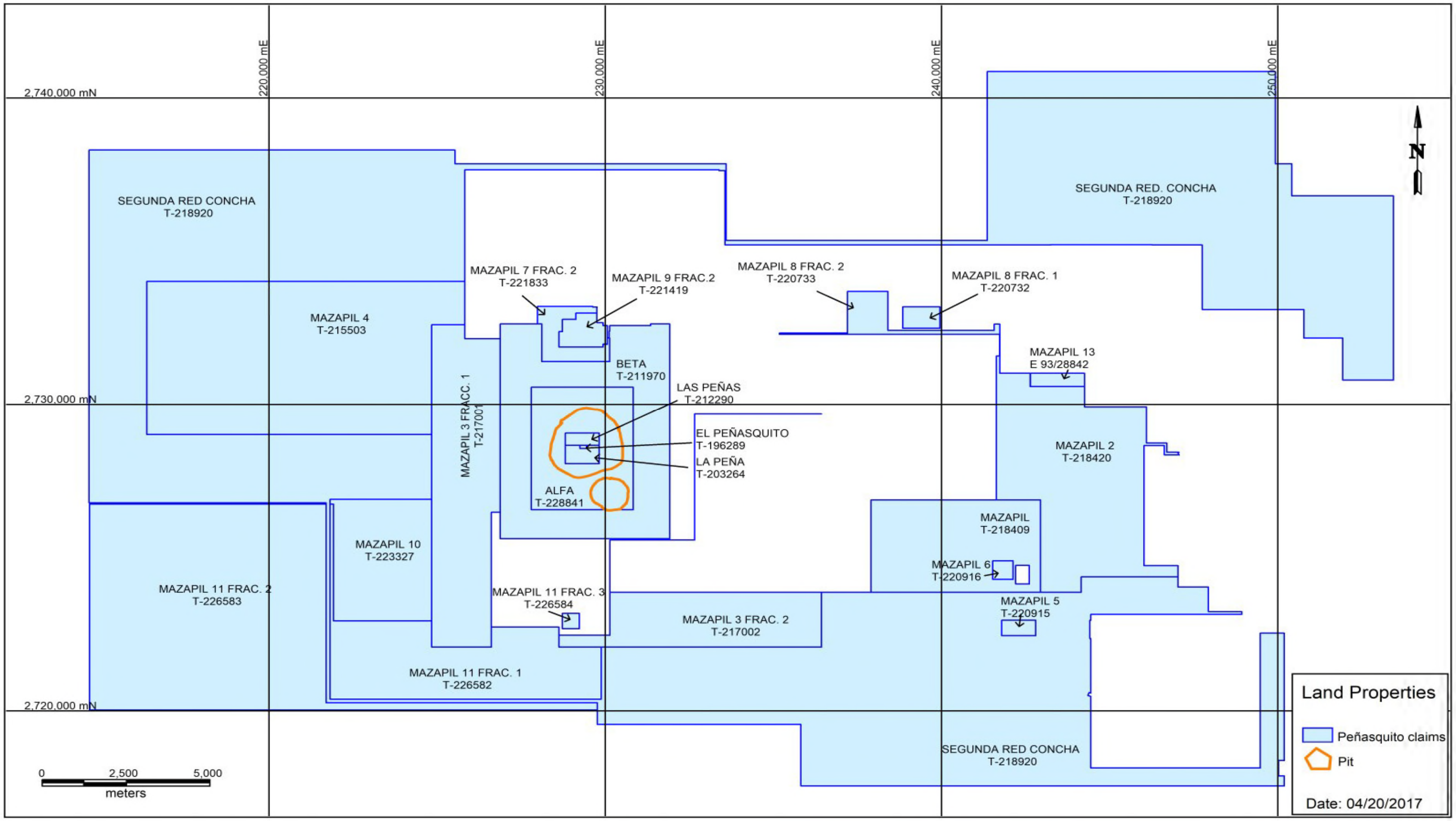
Goldcorp holds additional tenure in the greater Peñasquito area (within about 200 to 300 km of the Project infrastructure), which is under application, is granted, or is part of joint ventures with third parties.

Table 4.1: Mineral Tenure Table – Peñasquito Project Concessions Held By Minera Peñasquito SA de C.V

Num	Name	File	Title	Validity		Area (ha)	Holder	Location		Mining Unit Or Project	Recording RPM		
				From	To			Municipality	State		Num	Coot	Vol
1	La Peña	7/1.3/547	203264	28/06/1996	27/06/2046	58.0000	MP	Mazapil	Zac.	U. Peñasquito	142	284	290
2	Beta	8/1.3/01137	211970	18/08/2000	17/08/2050	2,054.7609	MP	Mazapil	Zac.	U. Peñasquito	175	350	314
3	Las Peñas	8/1.3/00983	212290	29/09/2000	28/09/2050	40.0000	MP	Mazapil	Zac.	U. Peñasquito	155	310	315
4	Mazapil 4	007/13859	215503	22/02/2002	21/02/2052	4,355.0995	MP	Mazapil	Zac.	U. Peñasquito	142	283	324
5	Mazapil 3 Frac. I	007/13852	217001	14/06/2002	13/06/2052	1,950.7022	MP	Mazapil	Zac.	U. Peñasquito	171	341	328
6	Mazapil 3 Frac. II	007/13852	217002	14/06/2002	13/06/2052	1,161.9722	MP	Mazapil	Zac.	U. Peñasquito	171	342	328
7	Mazapil	8/1.3/01280	218409	05/11/2002	04/11/2052	1,476.0000	MP	Mazapil	Zac.	U. Peñasquito	155	309	332
8	Mazapil 2	8/1.3/01281	218420	05/11/2002	04/11/2052	2,396.6794	MP	Mazapil	Zac.	U. Peñasquito	160	320	332
9	Mazapil 5	8/1/01527	220915	28/10/2003	27/10/2053	50.0000	MP	Mazapil	Zac.	U. Peñasquito	148	295	339
10	Mazapil 6	8/1/01528	220916	28/10/2003	27/10/2053	36.0000	MP	Mazapil	Zac.	U. Peñasquito	148	296	339
11	Mazapil 9 Frac. 2	093/26783	221419	04/02/2004	03/02/2054	123.0907	MP	Mazapil	Zac.	U. Peñasquito	40	79	341
12	Mazapil 7 Frac. 2	093/26734	221833	02/04/2004	01/04/2054	224.0083	MP	Mazapil	Zac.	U. Peñasquito	67	133	342
13	Mazapil 10	93/26975	223327	02/12/2004	01/12/2054	1,073.5553	MP	Mazapil	Zac.	U. Peñasquito	94	187	346
14	Mazapil 11 Frac. 1	093/27461	226582	27/01/2006	26/01/2056	1,974.4668	MP	Mazapil	Zac.	U. Peñasquito	101	202	355
15	Mazapil 11 Frac. 2	093/27461	226583	27/01/2006	26/01/2056	4,535.8175	MP	Mazapil	Zac.	U. Peñasquito	102	203	355
16	Mazapil 11 Frac. 3	093/27461	226584	27/01/2006	26/01/2056	25.0000	MP	Mazapil	Zac.	U. Peñasquito	102	204	355
17	Segunda Reduccion Concha	8/4/00059	228418	07/11/2000	06/11/2050	23,115.7895	MP	Mazapil	Zac.	U. Peñasquito	119	238	360
18	Alfa	8/4/00072	228841	11/10/1995	10/10/2045	1,100.0000	MP	Mazapil	Zac.	U. Peñasquito	151	301	361
19	El Peñasquito	9/6/00116	236746	26/08/2010	25/08/2060	2.000	MP	Mazapil	Zac	U. Peñasquito	143	286	383
20	Mazapil 13	093/28842	234494	03/07/2009	02/07/2059	70.134	MP	Mazapil	Zac.	U. Peñasquito	97	194	377
TOTAL HECTARES						45,823.0770							

Note: MP = Minera Peñasquito

Figure 4.1: Project Tenure Map



Note: Figure prepared by Goldcorp, 2017. Peñasquito claims are shown in pale blue.

4.3 Surface Rights

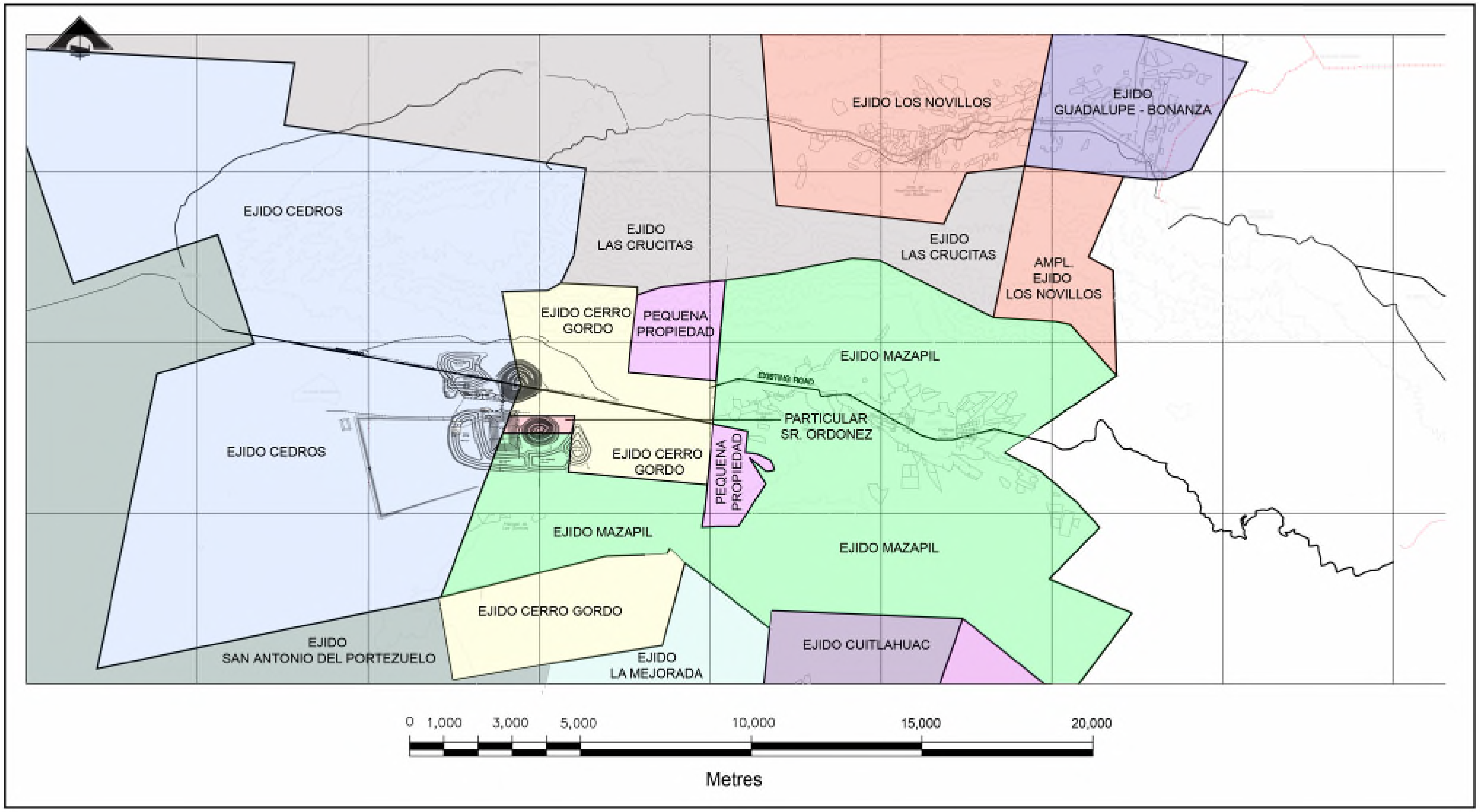
Surface rights in the vicinity of the Chile Colorado and Peñasco open pits are held by four ejidos: Ejido Cedros, Ejido Mazapil, Ejido El Vergel and Ejido Cerro Gordo, as well as certain private owners (Figure 4-2).

Agreements and agreement durations with the ejidos are provided in Table 4-2. Table 4-3 provides the list of key agreements with private owners. Additional agreements can be entered into to facilitate mining and exploration activities, when appropriate.

Under current agreements with the ejidos, payments are made to the ejidos on an annual basis, in addition to certain upfront payments that have already been made. All temporary occupancy (i.e. land use) agreements are filed with the Public Agrarian Registry and the Public Mining Registry.

Additional to the listed agreements, Goldcorp has entered into around 30 easement agreements with individual parcel owners for the construction and maintenance of the La Pardita–Cedros Highway, as well as 50 easement agreements in relation to the construction and maintenance of the El Salero–Peñasquito Powerline. Goldcorp holds all necessary permits for the power line and road access to site.

Figure 4.2: District Surface Rights Map



Note: Figure prepared by Goldcorp, 2014.

Table 4.2: Surface Rights Agreements, Ejidos

	Date of Agreement	Term	Hectares
Ejido Cedros	March 16, 2006	30 years	4,523.57 ha
	June 26, 2008	30 years	1,265.50 ha
Ejido Mazapil	July 17, 2006	30 years	280.80 ha
	August 22, 2006	30 years	1,500 ha
Ejido El Vergel	June 30, 2007 (replaced August 21, 2013)	15 years from January 1, 2014 with option to extend for additional 15 years	900 ha
	June 30, 2007 (replaced August 21, 2013)	15 years from January 1, 2014 with option to extend for additional 15 years	160 ha
	June 29, 2015	30 years	450 ha
	June 29, 2015	30 years	25 ha
	June 29, 2015	30 years	25 ha (possession)
Ejido Cerro Gordo	February 28, 2015	30 years	599 ha
Ejido General Enrique Estrada	November 19, 2014	29 years	128 ha
	November 19, 2014	29 years	5.35 ha
Ejido Tecolotes	October 30, 2014	29 years	146 ha
	October 30, 2014	10 years	28 ha
	October 30, 2014	29 years	4.5 ha
Ejido El Rodeo	February 1st, 2014	30 years	129 has
	December 6, 2014	29 years	150 ha
	December 6, 2014	29 years	6.9 ha
Ejido Matamoros	March 30, 2015	27 years	134 ha

Table 4.3: Surface Rights Agreements, Private Owners

	Date of Agreement	Term	Hectares
Juana María Alemán	October 23, 2013	Perpetual	1650 ha
Armando Vazquez Ramos	July 4, 2013	Perpetual	2858 ha
Armando Valdez Espinoza	September 5, 2013	Perpetual	1.4 ha
Ramón Gallegos	August 6, 2015	Perpetual	1250 ha
J. Ascención Carrillo Nava	March 12, 2009	Perpetual	120 ha
Francisco Melo Valdez	January 14, 2008	Perpetual	80 ha
Micaela Hernandez García	January 14, 2008	Perpetual	80 ha
Antonio Torres Pichardo	July 19, 2007	Perpetual	120 ha
Baldomiano Rangel Cepeda	September 26, 2014	Perpetual	140 ha
Jesus Rangel Vazquez|	January 29, 2008	Perpetual	80 ha

	Date of Agreement	Term	Hectares
Guadalupe Rodríguez Avila	September 24, 2014	Perpetual	203 ha
Cezaria Rangel Vazquez	January 29, 2008	Perpetual	50 ha
J. Guadalupe Rangel Vazquez	January 29, 2008	Perpetual	50 ha
Rafael Sandoval Hernandez	May 27, 2013	Perpetual	100 ha
Efrain García Dueñes	July 8, 2008	Perpetual	150 ha
Emigdio Casas	June 10, 2015	Perpetual	100 ha
J. Felix Hernandez Casas	June 10, 2015	Perpetual	100 ha
Ramón Perez Lopez	April 6, 2011	Perpetual	120 ha
Felipe Hernandez Casas	January 2011	Perpetual	100 ha
Hilario Casas Martinez	January 2011	Perpetual	100 ha
Felipe Isaias Rodarte	January 2011	Perpetual	100 ha
Bernardo Rios Esparza	September 30, 2005	Perpetual	19 ha
Eliodoro Rios Reyes	September 30, 2005	Perpetual	5 ha
María de Jesus Esparza Orozco	September 30, 2005	Perpetual	3 ha
Jorge Armando Briones Ordoñez	October 2, 2009	Perpetual	4.3 ha
Jorge Armando Briones Ordoñez	October 2, 2009	Perpetual	0.2 ha
José Cupertino Ordóñez Cabrera	November 18, 2005	Perpetual	14 ha
Joaquin Ordoñez Cabrera	October 27, 2005	Perpetual	19 ha
Filiberto Cervantes Ordoñez	October 2, 2009	Perpetual	14 ha
Jose Guadalupe Ordoñez Lopez	January 2, 2006	Perpetual	100 ha
Doroteo Cervantes Ordoñez	April 24, 2007	Perpetual	10 ha
Efren Espinoza Ordoñez	September 29, 2006	Perpetual	19 ha
Efren Espinoza Ordoñez	September 29, 2006	Perpetual	0.25 ha
Anastacio Martinez Ordoñez	October 19, 2006	Perpetual	4 ha
Anastacio Martinez Ordoñez	October 19, 2006	Perpetual	5 ha
Nazario Cabrera Muñiz	October 19, 2006	Perpetual	4 ha
Nazario Cabrera Muñiz	October 19 2006	Perpetual	6 ha
Federica Ordoñez Morquecho	September 29, 2006	Perpetual	5 ha
Federica Ordoñez Morquecho	September 29, 2006	Perpetual	8 ha
Arnulfo Cervantes Ordoñez	September 29, 2006	Perpetual	4 ha
Arnulfo Cervantes Ordoñez	September 29, 2006	Perpetual	9 ha
Rito Lopez Diaz	November 09, 2006	Perpetual	3 ha
Antonia Nava Ordoñez	September 29, 2006	Perpetual	11 ha
Juan Antonio Yañez Cortez	November 14, 2006	Perpetual	5 ha
Maria Dolores Corpus Herrera	October 24, 2006	Perpetual	2 ha
Jesus Martinez Ordoñez	October 19, 2006	Perpetual	9 h
Jose Rafael Cervantes Ordoñez	February 20, 2009	Perpetual	11 ha
Rogelio Cervantes Ordoñez	March 6, 2013	Perpetual	10 ha

4.4 Water Rights

The National Water Law and its regulations control all water use in Mexico. Comisión Nacional del Agua (CNA) is the responsible agency. Applications are submitted to this agency indicating the annual water needs for the mine operation and the source of water to be used. The CNA grants water concessions based on water availability in the source area.

Hydrogeological studies are complete that show the aquifers in the Cedros Basin (the groundwater basin containing the Project) have enough available water to provide 40 Mm^3 per year. The Project has received permits to pump up to 35 Mm^3 of this water per year. Based on completed applications, a 4.6 Mm^3 concession was obtained in August 2006 and an additional water concession of 9.1 Mm^3 per year was received in early 2008.

A Title of Concession (TC) to pump 4.837 Mm^3 was received in November 2008. A TC to pump an additional 0.450 Mm^3 was obtained in April 2009 and an additional 16.87 Mm^3 TC was obtained in July 2009.

Additional information on the Project water supply is included in Section 18.4.

4.5 Royalties

A 2% net smelter return (NSR) royalty is payable to Royal Gold on production from both the Chile Colorado and Peñasco locations.

The Mexican Government levies a 7.5% mining royalty that is imposed on earnings before interest, taxes, depreciation, and amortization.

There is also a 0.5% environmental erosion fee payable on precious metals production, based on gross revenues.

4.6 Agreements

On 24 July 2007, Goldcorp and Wheaton PM entered into a transaction where Wheaton PM acquired 25% of the silver produced over the life-of mine (LOM) from the Peñasquito Project for an upfront cash payment of US$485 million. Wheaton PM will pay Goldcorp a per-ounce cash payment of the lesser of US$3.90 and the prevailing market price (subject to an inflationary adjustment commencing in 2011), for silver delivered under the contract.

4.7 Easements and Rights of Way

Power line and road easements have been granted to the Project.

4.8 Permits, Environment and Social Licence

The current status of the environment permitting and study status, community consultation and the social licence to operate is discussed in Section 20.

4.9 Comments on Section 4

The responsible QP notes:

- Goldcorp holds 100% of the Project; mineral tenure is in the name of Minera Peñasquito, an indirectly wholly-owned Goldcorp subsidiary;
- Information provided by Goldcorp legal experts supports that the mining tenure held is valid and is sufficient to support declaration of Mineral Resources and Mineral Reserves;
- Goldcorp currently holds sufficient surface rights in the Project area to support the mining operations, including provisions for access and power lines;
- Wheaton PM is entitled to 25% of the silver produced over the LOM from the Peñasquito Operations;
- A 2% NSR royalty is payable to Royal Gold on production from both the Chile Colorado and Peñasco locations;
- Royalties are payable to the Government of Mexico and include a 7.5% mining royalty and a 0.5% environmental erosion fee; and
- Goldcorp is not aware of any other significant environmental, social or permitting issues that would prevent continued exploitation of the deposits.

5.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, AND PHYSIOGRAPHY

5.1 Accessibility

There are two access routes to the operations. The first is via a turnoff from Highway 54 onto the State La Pardita road, then onto the Mazapil to Cedros State road. The mine entrance is approximately 10 km after turning northeast onto the Cedros access road.

The second access is via the Salaverna by-pass road from Highway 54 approximately 25 km south of Concepcion Del Oro. The Salaverna by-pass is a new, purpose-built gravel road that eliminates steep switchback sections of cobblestone road just west of Concepción Del Oro and passes the town of Mazapil. From Mazapil, this is a well-maintained 12 km gravel road that accesses the mine main gate.

Within the operations area, access is primarily by gravel roads, and foot trails and tracks.

The closest rail link is 100 km to the west.

There is a private airport on site and commercial airports in the cities of Saltillo, Zacatecas and Monterrey. Travel from Monterrey/Saltillo is approximately 260 km, about three hours to site. Travel from Zacatecas is approximately 275 km, about 3.5 hours to site.

5.2 Climate

The climate is generally dry with precipitation being limited for the most part to a rainy season in the months of June and July. Annual precipitation for the area is approximately 700 mm, most of which falls in the rainy season. Temperatures range between 30ºC and 20ºC in the summer and 15ºC to 0ºC in the winter.

Mining operations are conducted year-round. The Project area can be affected by tropical storms and hurricanes which can result in short-term, high-precipitation events.

5.3 Local Resources and Infrastructure

A skilled labour force is available in the region and surrounding mining areas of Mexico. Fuel and supplies are sourced from nearby regional centres such as Monterrey, Monclova, Saltillo and Zacatecas and imports from the US via Laredo.

Accommodation comprises a 3,421-bed camp with full dining, laundry and recreational facilities.

Additional infrastructure information is included in Section 18.

5.4 Physiography

The Project is situated in a wide valley bounded to the north by the Sierra El Mascaron and the south by the Sierra Las Bocas. The prevailing elevation of the property is approximately 1,900 m above sea level. The terrain is generally flat, with some rolling hills.

Vegetation is principally scrub, with cactus and coarse grasses.

Except for one small outcrop, the area is covered by up to 30 m of alluvium.

5.5 Comments on Section 5

In the opinion of the QPs:

- There is sufficient suitable land available within the Goldcorp mineral tenure for tailings disposal, mine waste disposal, and mining-related infrastructure such as the open pit, process plant, workshops and offices;
- A review of the power and water sources, manpower availability, and transport options indicate that there are reasonable expectations that sufficient labour and infrastructure is available or under construction to support declaration of Mineral Resources, Mineral Reserves, and the proposed mine plan; and
- Mining activities are conducted on a year-round basis.

6.0 HISTORY

In 1568, Spanish explorers discovered gold–silver deposits at Concepcion del Oro, 30 km to the east of the Peñasquito Operations. Since then, the Concepcion del Oro area has produced 1.5 million ounces of gold and 250 million ounces silver. At about the same time, the Spanish also worked at the Project developing shallow shafts and pits.

A summary of the known exploration completed in the Peñasquito Operations area is included as Table 6-1.

Mine construction commenced in 2007. Initial concentrates were produced as part of the commissioning process in October 2009. A production summary from 2010 to the end of the second quarter of 2018 is included in Section 17.

The remainder of this Report discusses an updated Mineral Resource and Mineral Reserve estimate for the Project, and the current production and process scenarios.

Table 6.1: Exploration Summary Table

Year	Operator	Work Undertaken
1950s	Minera Peñoles	Excavation of a 61 m shaft with a crosscut to the old workings and completion of two drill holes.
1994–1998	Minera Kennecott SA de CV (Kennecott)	Discovery of two large mineralized diatreme breccia bodies, the Outcrop (Peñasco) and Azul Breccias. Geochemical surveys. Gravity, CSAMT, reconnaissance IP, scaler IP, airborne radiometrics and magnetics and ground magnetics surveys. 250 RAB drill holes (9,314 m). 72 RC and core drill holes (24,209 m): 23 drill holes were drilled in the Peñasco Outcrop Breccia zone, 15 drill holes at Brecha Azul, 13 drill holes at Chile Colorado, and other drill holes scattered outside these zones.
1998	Western Copper Holdings Ltd. (Western Copper)	Acquired Project from Kennecott. 9 core holes (3,185 m). 13.4 line km of Tensor CSAMT geophysical survey
2000	Minera Hochschild S.A (Hochschild)	14 core holes (4,601 m); 11 at Chile Colorado.
2000–2003	Western Copper	149 core and RC drill holes (496,752 m), and completion of a scoping study.
2003–2006	Western Silver Corporation (Western Silver)	Corporate name change from Western Copper to Western Silver. 300 core and RC drill holes, including 13 metallurgical drill holes. Scoping, pre-feasibility and feasibility studies completed. Glamis Gold acquired Western Silver in May 2006; Glamis Gold was acquired by Goldcorp in November 2006.
2012	CIVIS Inc on behalf of Goldcorp	Topography surface to constrain the Mineral Resources/Mineral Reserves estimation was flown on May 25, 2012; flight over the open pit area covered 16 km2 and had a resolution of 10 cm
2006-2018	Goldcorp	286 core and 93 RC exploration drill holes, plus 46 metallurgical, 40 geotechnical, 298 condemnation, and 26 in-fill drill holes. Updated feasibility study. Mining began in July 2007, the first doré was produced in May 2008, mechanical completion of the first mill/ flotation line (50 kt/d) was achieved in July 2009, and the first concentrates were produced and shipped in October 2009. High-sensitivity aeromagnetic and FALCON Airborne Gravity Gradiometer system flown in 2010; 1,789 line-km of data acquired HELITEM time domain EM helicopter survey flown in 2010–2011; 1,597 line-km of data acquired 59 shallow RC drill-holes to evaluate bedrock under alluvial cover in 2011 85 core holes drilled in 2012 (52,991.35 m); 72 core holes drilled in 2013 (43342.2 m); 129 core holes drilled in 2014 (48,825.5 m); 101core holes drilled in 2015 (44,854 m); 124 cores holes drilled in 2016 (44,715 m). 77 holes drilled in 2017 (18,813 m), 8 holes drilled up to mid-2018 (1,940 m)

7.0 GEOLOGICAL SETTING AND MINERALIZATION

7.1 Regional Geology

The regional geology of the project area is dominated by Mesozoic sedimentary rocks, which are intruded by Tertiary stocks of intermediate composition (granodiorite and quartz monzonite) and overlain by Tertiary terrestrial sediments and Quaternary alluvium. The Mesozoic sedimentary rocks comprise a >2.5 km thick series of marine sediments deposited during the Jurassic and Cretaceous Periods with a 2,000 m thick sequence of carbonaceous and calcareous turbiditic siltstones and interbedded sandstones underlain by a 1,500 m to 2,000 m thick limestone sequence.

The oldest rocks in the area are the Upper Jurassic limestones and cherts of the Zuloaga Formation, with the low clastic content consistent with deposition in a shallow epicontinental sea. These rocks are overlain by the La Caja Formation, a variably fossiliferous series of thinly-bedded phosphatic cherts and silty to sandy limestones, possibly recording a period of sea level fluctuations. The La Caja Formation is in turn overlain by limestones and argillaceous limestones of the Taraises Formation, with increasing chert and disseminated pyrite near the top of the formation. The massive limestones of the overlying Cupido Formation form one of the favourable host rocks for much of the mineralization previously mined in the area. The Cupido Formation limestones are overlain by the cherty limestones of the La Peña Formation, deposited during the Lower Cretaceous Period. These rocks are in turn overlain by the thickly-bedded limestones of the Cuesta del Cura Formation.

There is an abrupt change in sedimentation style at the base of the Indidura Formation, which is a series of shales, calcareous siltstones and argillaceous limestones, possibly indicating a shallowing of the marine depositional environment. Upper Cretaceous rocks of the overlying Caracol Formation consist primarily of interbedded siltstones and sandstones and represent a change to dominantly clastic sediments within the depositional basin.

Following a period of compressional deformation, uplift and subsequent erosion, the Mesozoic marine sediments were overlain by the Tertiary Mazapil Conglomerate.

Large granodiorite stocks are interpreted to underlie large portions of the mineralized areas within the Concepción Del Oro District, including the Peñasquito area. Slightly younger quartz–feldspar porphyries, quartz monzonite porphyries, and other feldspar-phyric intrusions occurring as dikes, sills, and stocks cut the sedimentary units. The intrusions are interpreted to have been emplaced from the late Eocene to mid-Oligocene and have been dated at 33–45 Ma. Samples of granodiorite and quartz–feldspar porphyry at and near Peñasquito produced U–Pb age dates of 37–40 Ma and 36.2-37.1 Ma, respectively.

7.2 Project Geology

The Mesozoic sedimentary rocks of the Mazapil area were folded into east–west arcuate folds during the Laramide orogeny. End-Laramide extension was accommodated by northwest-, northeast- and north- striking faults, contemporaneous with deposition of Tertiary terrestrial sediments in fault–bounded basins. Tertiary granodiorite, quartz monzonite, and quartz–feldspar porphyry were also intruded during this period of extension (Figure 7-1).

Current topography reflects the underlying geology, with ranges exposing anticlines of the older Mesozoic rocks, while valleys are filled with alluvium and Tertiary sediments overlying synclinal folds in younger Mesozoic units. Tertiary stocks and batholiths are better exposed in the ranges.

Two breccia pipes, Peñasco and Brecha Azul, intrude Caracol Formation siltstones in the centre of the Mazapil valley; the Peñasco diatreme form the principal host for known gold–silver–lead–zinc mineralization at the Peñasquito deposit. The Chile Colorado deposit comprises mineralized sedimentary rocks adjacent to the Brecha Azul diatreme.

The breccia pipes are believed to be related to quartz–feldspar porphyry stocks beneath the Peñasquito area. The current bedrock surface is estimated to be a minimum of 50 m (and possibly several hundred metres) below the original paleo-surface when the diatremes were formed. The brecciated nature of the host rock indicates that the diatremes explosively penetrated the Mesozoic sedimentary units and it is likely that they breached the surface; however, eruption craters and ejecta aprons have since been eroded away.

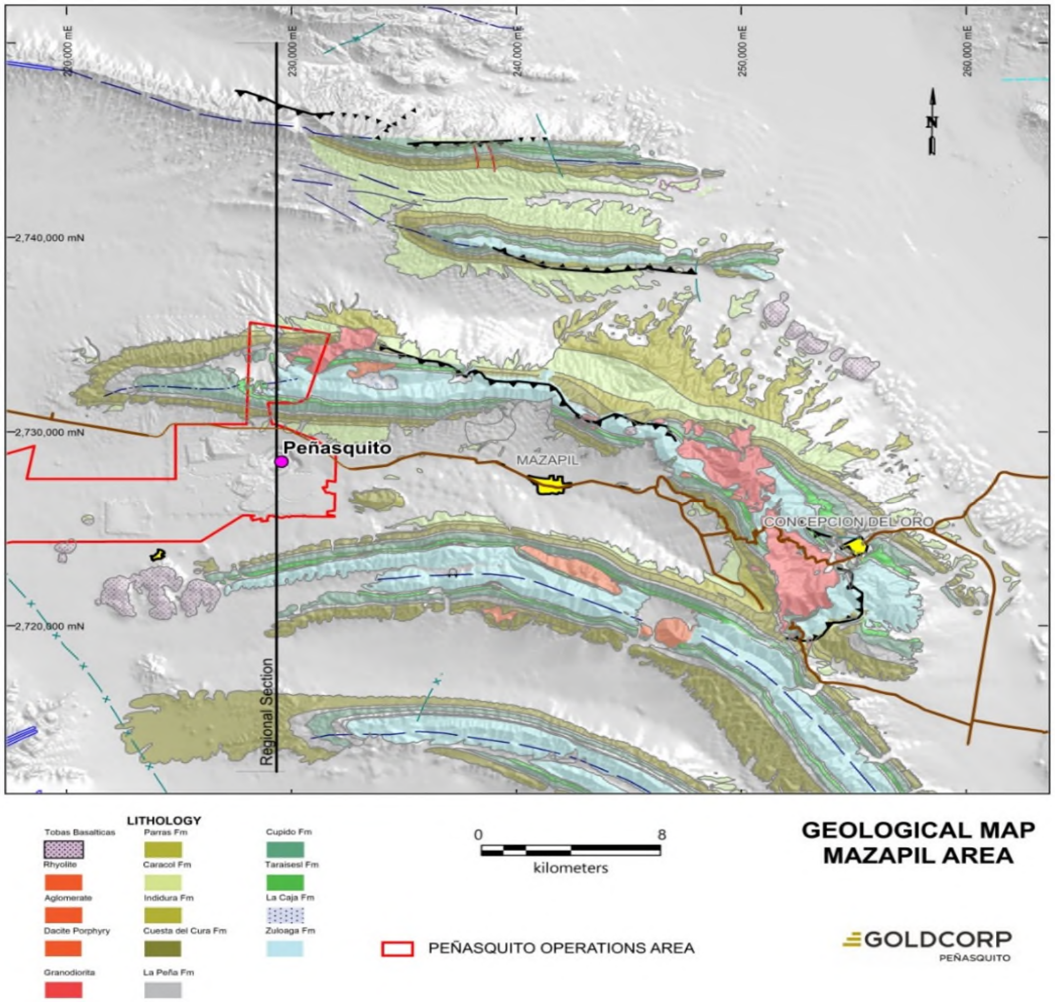
Alluvium thickness averages 30–50 m at Peñasquito, and this cover obscured the diatremes apart from one small outcrop of breccia near the center of the Peñasco diatreme, rising about 5 m above the valley surface. The single outcrop near the center of the Peñasco pipe contained weak sulphide mineralization along the south and west side of the outcrop, representing the uppermost expression of much larger mineralized zones below.

7.3 Deposit Geology

Peñasco and Brecha Azul are funnel-shaped breccia pipes, which flare upward, and are filled with brecciated sedimentary and intrusive rocks, cut by intrusive dikes (Figure 7-2).

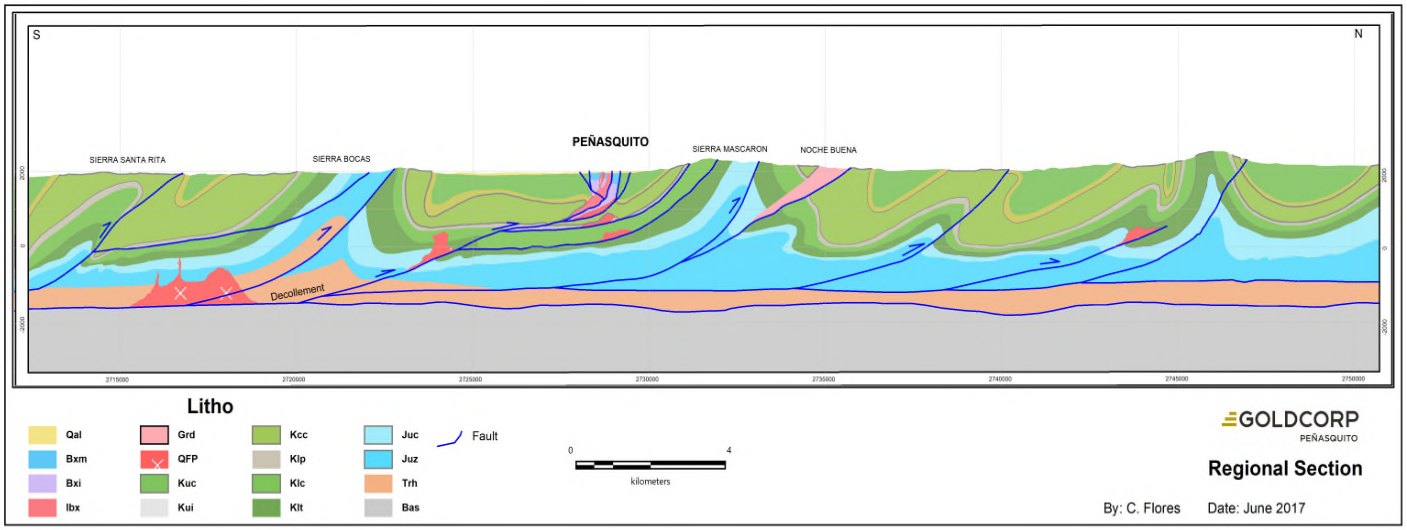
The larger diatreme, Peñasco, has a diameter of 900 m by 800 m immediately beneath surface alluvial cover, and diatreme breccias extend to at least 1,000 m below surface. The Brecha Azul diatreme, which lies to the southeast of Peñasco, is about 500 m in diameter immediately below alluvium, and diatreme breccias also extend to at least 1,000 m below surface. Porphyritic intrusive rocks intersected in drilling beneath the breccias may connect the pipes at depth.

Figure 7.1: Regional Geological Plan



Note: Figure prepared by Goldcorp, 2017.

Figure 7.2: Regional section



Note: Figure prepared by Goldcorp, 2017

Chile Colorado is a mineralized stock work located southwest of Brecha Azul, in sediments of the Caracol Formation, with the geometry of approximately 600 m by 400 m immediately beneath surface alluvial cover, and it extends to at least 500 m below the surface.

Polymetallic mineralization is hosted by the diatreme breccias, intrusive dikes, and surrounding siltstone and sandstone units of the Caracol Formation. The diatreme breccias are broadly classified into three units, in order of occurrence from top to bottom within the breccia column, which are determined by clast composition:

- Sediment-clast breccia;
- Mixed-clast breccia (sedimentary and igneous clasts);
- Intrusive-clast breccia.

Sedimentary rock clasts consist of Caracol Formation siltstone and sandstone; intrusion clasts are dominated by quartz–feldspar porphyry. For the purposes of the geological block model, the sediment-clast breccia (BXS), the sediment-crackle breccia (CkBx), mixed-clast breccia (BXM) and intrusion-clast breccia (BXI) are modeled as separate lithological solids.

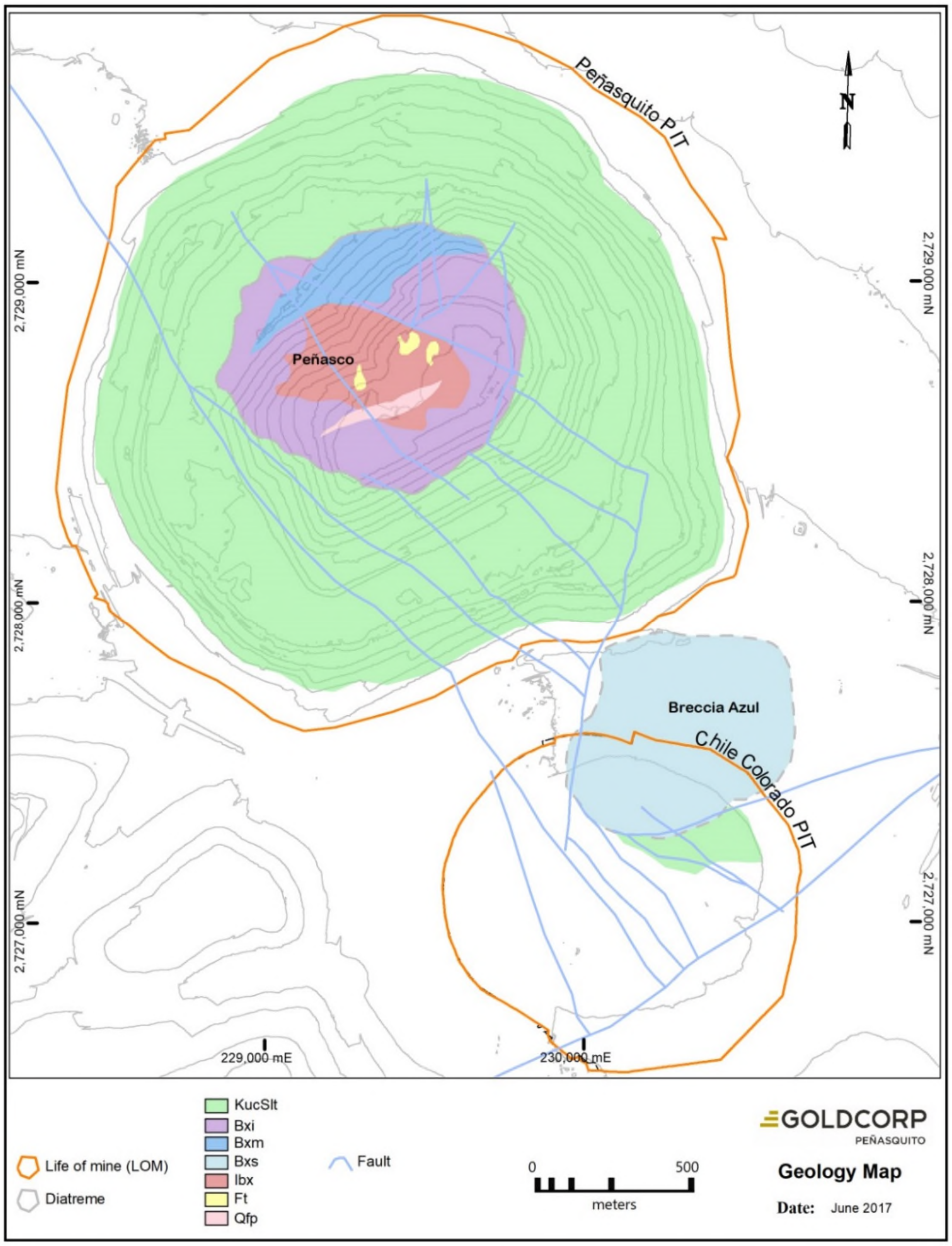
A variety of dikes cut the breccia pipes and the immediately adjacent clastic wall-rocks. These dikes exhibit a range of textures from porphyry breccia, to quartz–feldspar and quartz-eye porphyries, to porphyritic, to aphanitic micro breccias. For the block model, three intrusive lithologies are distinguished; brecciated intrusive rocks (IBX), felsites and felsic breccias (FI/FBX) and quartz–feldspar porphyry (QFP).

7.4 Structure

The Peñasco and Brecha Azul diatremes are considered to represent breccia-pipe deposits developed as a result of Tertiary intrusion-related hydrothermal activity. Alteration, mineral zoning, porphyry intrusion breccia clasts, and dikes all suggest the diatreme-hosted deposits represent distal mineralization some distance above an underlying quartz–feldspar porphyry system.

A complex structural setting related to thrust and associated tear fold structures, fissure structures and structures developed by piston effect, generated the structural conditions for the ascent and placement of new magma. The rising magma, when entering into contact with phreatic water, provoked violent explosions and brecciation, giving rise to the phreatomagmatic breccias. A number of mineralized fault zones have been identified and are included as solids in the block model.

Figure 7.3: Deposit Geology Plan

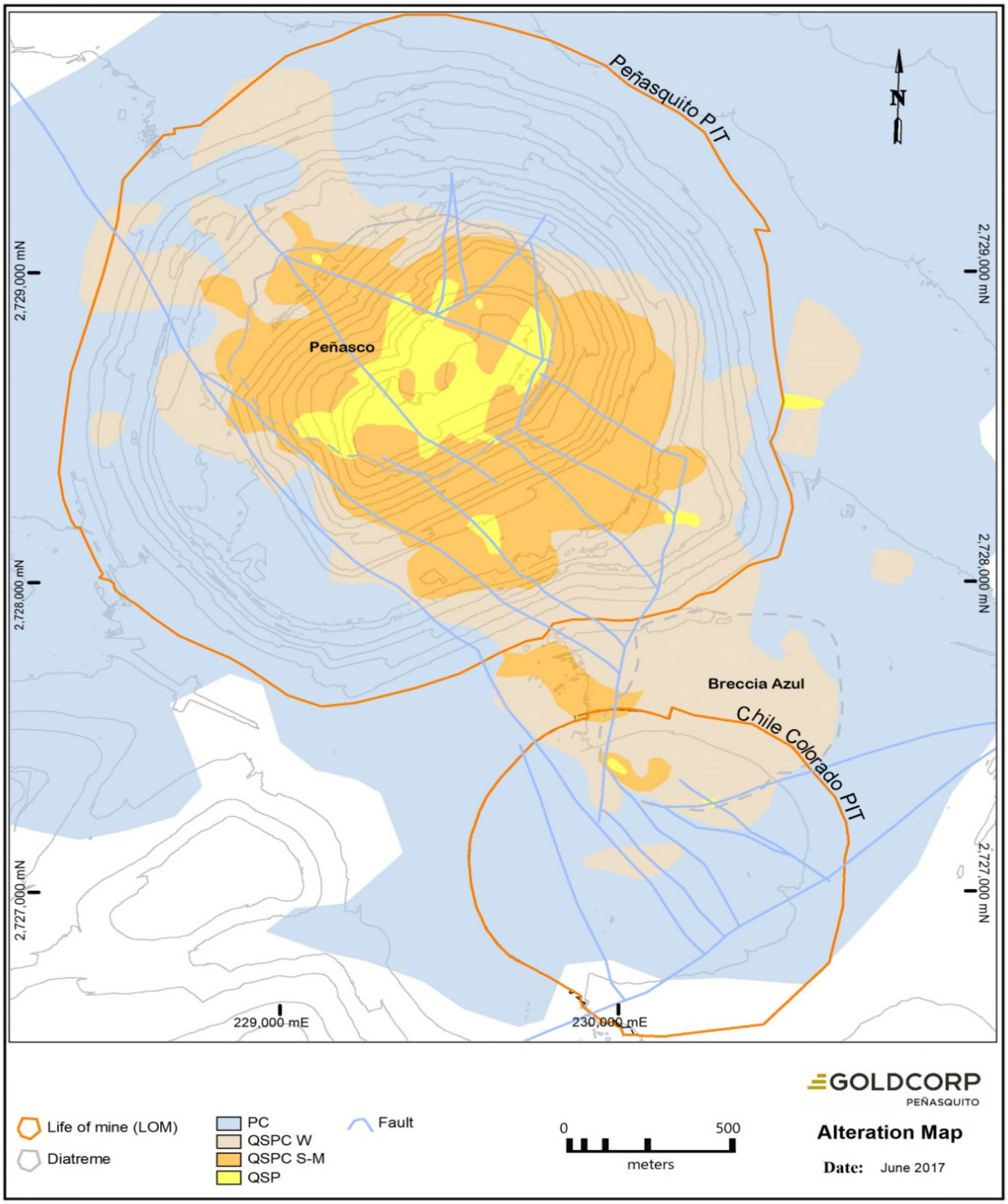


Note: Figure prepared by Goldcorp, 2017. KucSlt: Kuc Caracol Formation, siltstone>sandstone; Ckbx: crackle-breccia, sediment clast-supported breccias; QFP: quartz–feldspar porphyry; Bxi: sediment, QFP and Fi clasts / milled intrusive mixed hydrothermal breccia; Bxs: sediment clasts / milled sediment mixed breccias; Bxm: Mixed sediment>intrusive clasts / milled sediment–intrusive mixed breccia; Fi/Fbx: Felsite intrusive or breccia; ibx: quartz–feldspar porphyry intrusive breccia

7.5 Alteration

Both of the breccia pipes lie within a hydrothermal alteration shell consisting of a proximal sericite–pyrite–quartz (phyllic) alteration (QSP) assemblage, distal sericite–pyrite–quartz–calcite (QSPC) assemblage, and peripheral pyrite–calcite (PC) alteration halo (Figure 7-4). There is an inverse relationship between degree of alteration and organic carbon in the Caracol Formation sedimentary rocks, suggesting organic carbon was mobilized or destroyed during alteration.

Figure 7.4: Deposit Alteration Plan



Note: Figure prepared by Goldcorp, 2017.

7.6 Mineralization

The Peñasco deposit is centered on a diatreme breccia pipe and the Chile Colorado deposit is comprised of mineralized sedimentary rocks adjacent to the Brecha Azul diatreme. The diatreme and sediments contain and are surrounded by disseminated, veinlet and vein-hosted sulphides and sulphosalts containing base metals, silver, and gold.

Mineralization consists of disseminations, veinlets and veins of various combinations of medium to coarse-grained pyrite, sphalerite, galena, and argentite (Ag_2S). Sulphosalts of various compositions are also abundant in places, including bournonite ($PbCuSbS_3$), jamesonite ($PbSb_2S_4$), tetrahedrite, polybasite ($(Ag,Cu)_{16}(Sb,As)_2S_{11}$), and pyrargyrite ($Ag_3SbS_3$). Stibnite ($Sb_2S_3$), rare hessite (AgTe), chalcopyrite, and molybdenite have also been identified. Telluride minerals are the main gold-bearing phase, with electrum and native gold also being identified.

Gangue mineralogy includes calcite, sericite, and quartz, with rhodochrosite, fluorite, magnetite, hematite, garnets (grossularite–andradite) and chlorite–epidote. Carbonate is more abundant than quartz as a gangue mineral in veins and veinlets, particularly in the "crackle breccia" that occurs commonly at the diatreme margins.

Breccia-hosted mineralization is dominated by sulphide disseminations within the matrix with lesser disseminated and veinlet-controlled mineralization in clasts. All breccia types host mineralization, but the favoured host is the intrusion-clast breccia. Much of the mineralization within the Peñasco and Brecha Azul pipes lies within the intrusion-clast breccia.

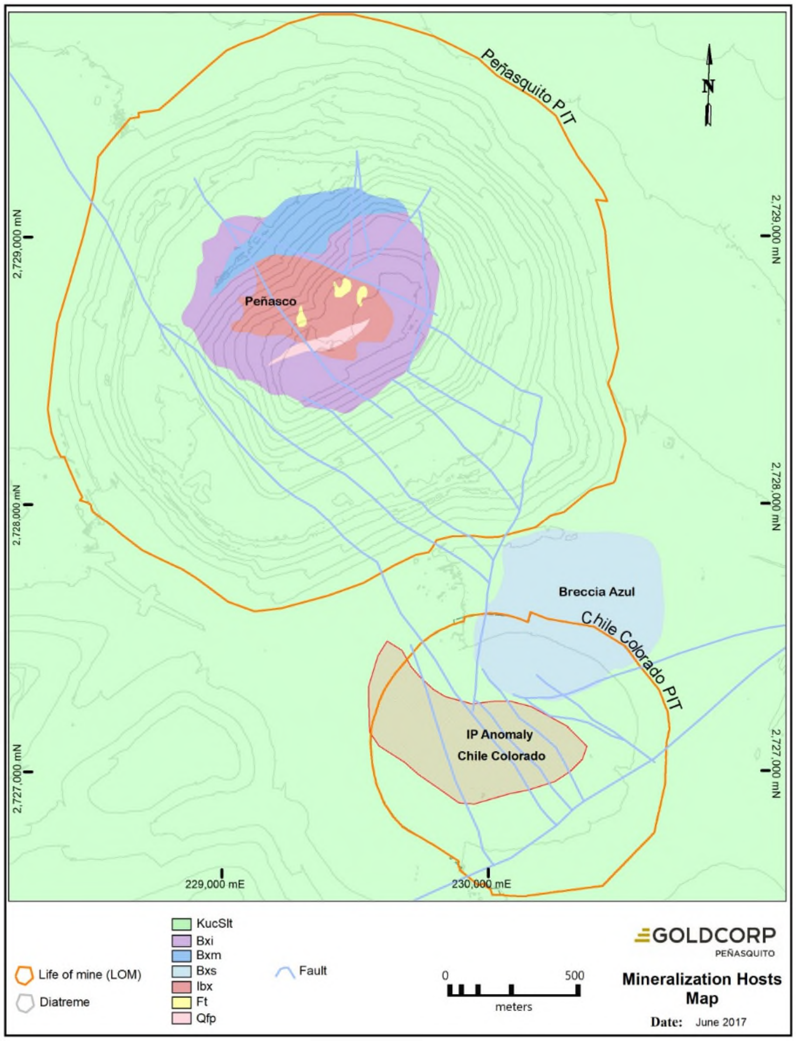
All of the dike varieties may also be mineralized, and they are almost always strongly altered. Mineralization of dikes occurs as breccia matrix fillings, disseminations and minor veinlet stockworks at intrusion margins, and veinlets or veins cutting the more massive dikes. Mineralized dikes form an important ore host in the Peñasco diatreme but are not as abundant in Brecha Azul.

Mineralization of the Caracol Formation clastic sedimentary units where the units are cut by the diatremes is dominated by sulphide replacement of calcite matrix in sandstone beds and lenses and disseminated sulphides and sulphide clusters in sandstone and siltstones. Cross-cutting vein and veinlet mineralization consists of sulphide and sulphide-calcite fillings.

The Chile Colorado deposit, southwest of the Brecha Azul diatreme, is the largest known sediment-hosted mineralized zone, although others also occur adjacent to Peñasco (e.g. El Sotol), and between the diatremes (e.g. La Palma) (Figure 7-5).

There is a spatial association between strong QSP alteration and the highest degree of sulphide and sulphosalt mineralization. A halo of generally lower-grade disseminated zinc–lead–gold–silver mineralization lies within the QSPC assemblage surrounding the two breccia pipes.

Figure 7.5: Penasco and Chile Colorado Deposit, Plan View



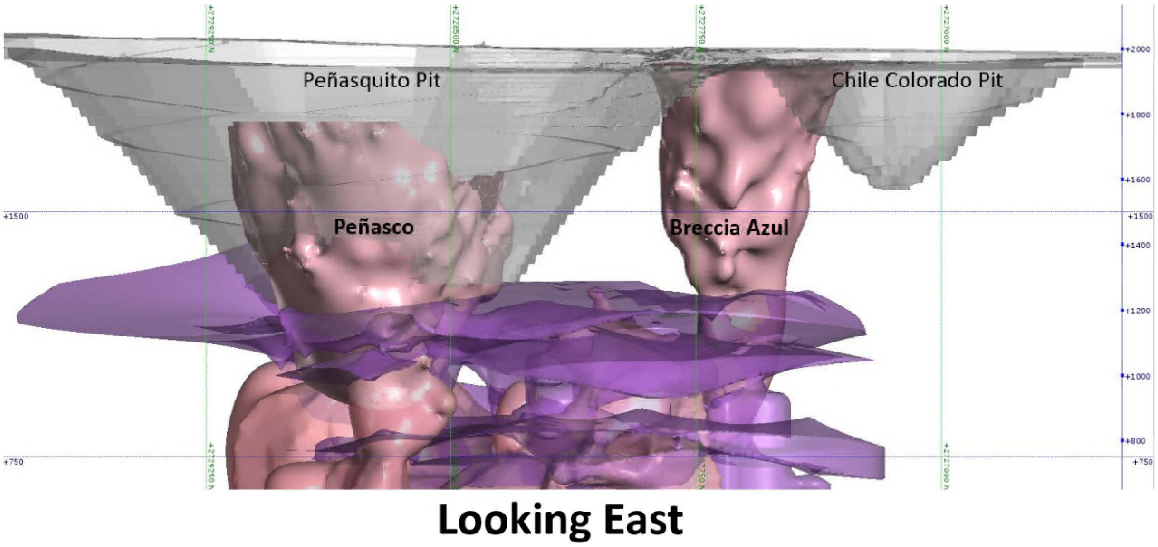
Note: Figure prepared by Goldcorp, 2017

7.7 Mantos

Mantos-style sulphide replacements of carbonate strata have been identified within and beneath the Caracol Formation adjacent to the diatreme pipes, beneath the clastic-hosted disseminated sulphide zones (Figure 7-6).

They consist of semi-massive to massive sulphide replacements of sub-horizontal limestone beds, as well as structurally-controlled cross-cutting chimney-style, steeply dipping, fracture and breccia zones filled with high concentrations of sulphides.

Figure 7.6: Mantos



Note: Figure prepared by Goldcorp, 2017. Horizontal distance across figure is approximately 4 km.

The sulphides are generally dominated by sphalerite and galena, but also contain significant pyrite. Gangue minerals (commonly carbonates) are subordinate in these strata-replacement mantos and cross-cutting chimneys.

Stratiform and chimney mantos are characterized by their very high zinc, lead, and silver contents, with variable copper and gold contributions.

7.8 Skarn-Hosted Mineralization

Garnet skarn-hosted copper–gold–silver–zinc–lead mineralization within dissolution breccias has been identified at depth between the Peñasco and Brecha Azul diatremes. Skarn-hosted mineralization identified to date occurs within the Indidura, Cuesta del Cura, Taraises and La Caja Formations. The main trend of this mineralization is northwest–southeast, with the best grades located between the diatremes. The skarn alteration envelope has horizontal dimensions of approximately 1,000 m by 1,200 m and is open at depth (Figure 7-7).

Polymetallic mineralization is hosted by garnet skarn and associated breccias, mainly as chalcopyrite and sphalerite with some gold and silver. Gangue minerals consist of pyrite, calcite, garnet, and magnetite. The garnet skarns are often surrounded by halos of hornfels, especially in siliciclastic units, and/or marble and recrystallized limestone in carbonate units. The deep exploration programs have also identified quartz feldspar porphyry with strong QSPC and potassic alteration, which contain occasional veinlets of quartz with molybdenite, and veins with secondary biotite and magnetite disseminated in the wall rocks.

7.9 Prospects

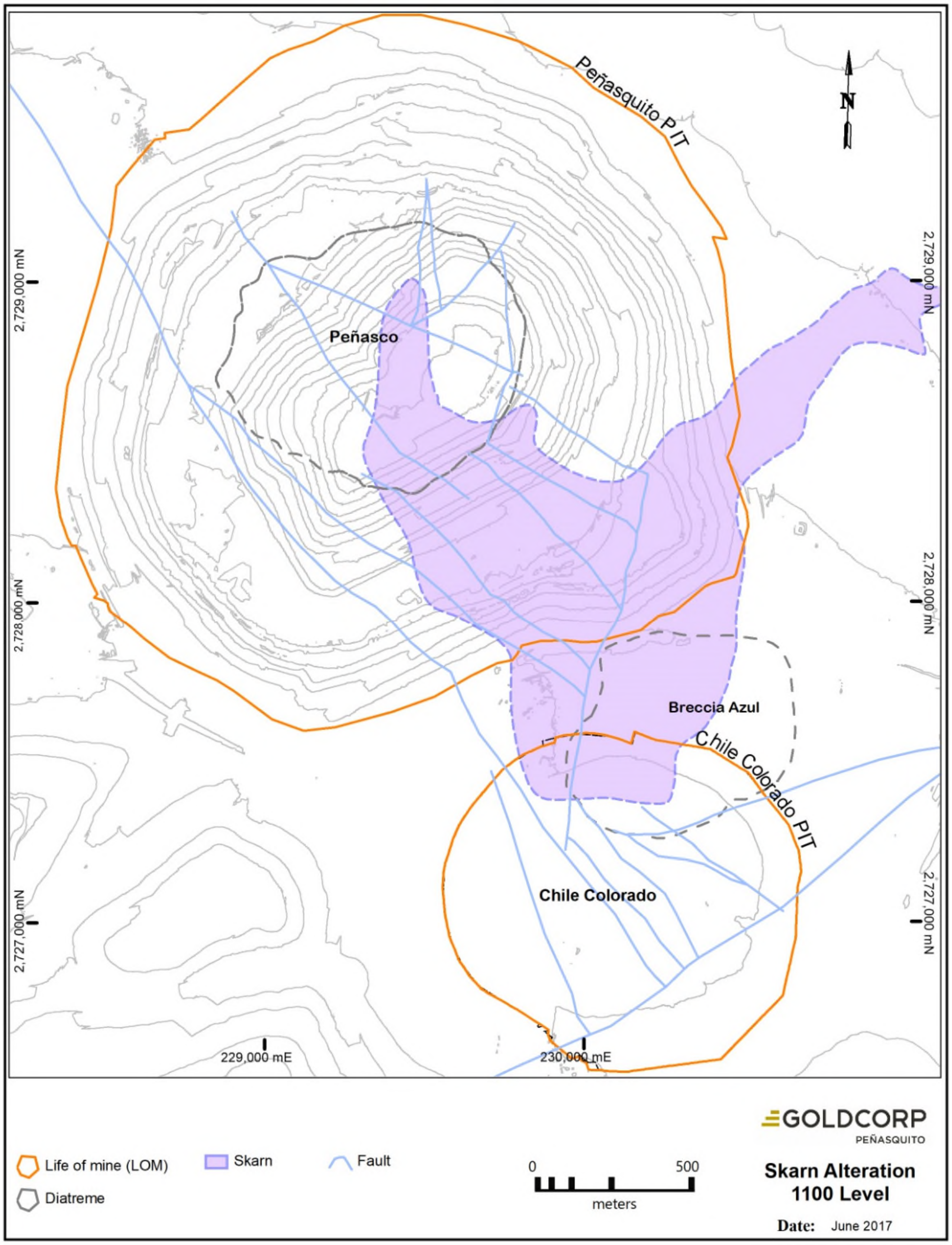
Exploration targets and prospects are discussed in Section 9.

7.10 Comments on Geological Setting and Mineralization

In the opinion of the QPs:

- At present all economically-defined mineralized zones in the project area lie within the breccia pipes and the adjacent siltstones of the Caracol Formation. Additional mineralization has been identified within limestones beneath the Caracol Formation; these manto- and skarn-style deposits provide future exploration opportunities;
- Knowledge of the deposit settings, lithologies, and structural and alteration controls on mineralization is sufficient to support Mineral Resource and Mineral Reserve estimation and to support mine planning; and
- The mineralization style and setting of the deposit is sufficiently well understood to support Mineral Resource and Mineral Reserve estimation.

Figure 7.7: Skarns



Note: Figure prepared by Goldcorp, 2017.

8.0 DEPOSIT TYPES

Deposits within the Peñasquito Operations are considered to be examples of breccia pipe deposits developed as a result of intrusion-related hydrothermal activity. Global examples of such deposits include Kidston (Australia), Montana Tunnels (Montana), and Cripple Creek (Colorado).

Typical deposit settings include

- Metaluminous, subalkalic intrusions of intermediate to felsic composition that span the boundary between ilmenite- and magnetite-series;
- Carbonic hydrothermal fluids;
- Spatially restricted, commonly weak hydrothermal alteration, except in systems formed at the shallowest depths spanned by these deposits. Thermal gradients surrounding cooling plutons are steep and result in temperature-dependent concentric metal zones that develop outward from pluton margins for distances up to a few kilometres, or just beyond the thermal aureole. Pluton-proximal gold mineralization may be associated with bismuth, tellurium and tungsten; aureole-hosted mineralization will have an arsenic or antimony tenor, and distal mineralization may be related to silver–lead–zinc;
- A tectonic setting of continental magmatism well-inboard of inferred or recognized convergent plate boundaries, and which commonly contains coeval intrusions of alkalic, metaluminous calc-alkalic, and peraluminous compositions. Preferred host strata include reducing basinal sedimentary or metasedimentary rocks.

Deposit locations are often controlled by graben faults and ring complexes related to cauldron development.

Deposits typically consist of mineralized, funnel-shaped, pipe-like, discordant breccia bodies and sheeted fracture zones. Mineralization is hosted by a variety of breccia types, including magmatic-hydrothermal, phreatomagmatic, hydraulic and collapse varieties. Breccia cement consists dominantly of quartz and carbonate (calcite, ankerite, siderite), with specularite and tourmaline at some deposits.

Mineralization characteristically has a low sulphide content (<5 volume %), and contains pyrite, chalcopyrite, sphalerite, galena, and pyrrhotite, with minor molybdenite, bismuthinite, tellurobismuthite and tetrahedrite, which occur either in the matrix or in rock fragments. Mineralization is typically silver-rich (gold:silver ratios of 1:10), with associated lead, zinc, copper, ± molybdenum, manganese, bismuth, tellurium, and tungsten), and a lateral (concentric) metal zoning is present at some deposits.

A sericite–quartz–carbonate–pyrite alteration assemblage and variably developed silicification is coincident with mineralized zones, grading outward into propylitic alteration. An early stage potassium-silicate alteration can be present at some deposits.

The deposit model diagram included as Figure 8-1 is an interpretation of the deposit model relationships at Peñasquito as collated and interpreted from mapping, drilling, and geophysical studies undertaken in the area. The model displays not only the known breccia, mantos and skarn deposits, but additional mineralization styles that may be developed in the Project area, such as porphyry-related disseminated deposits.

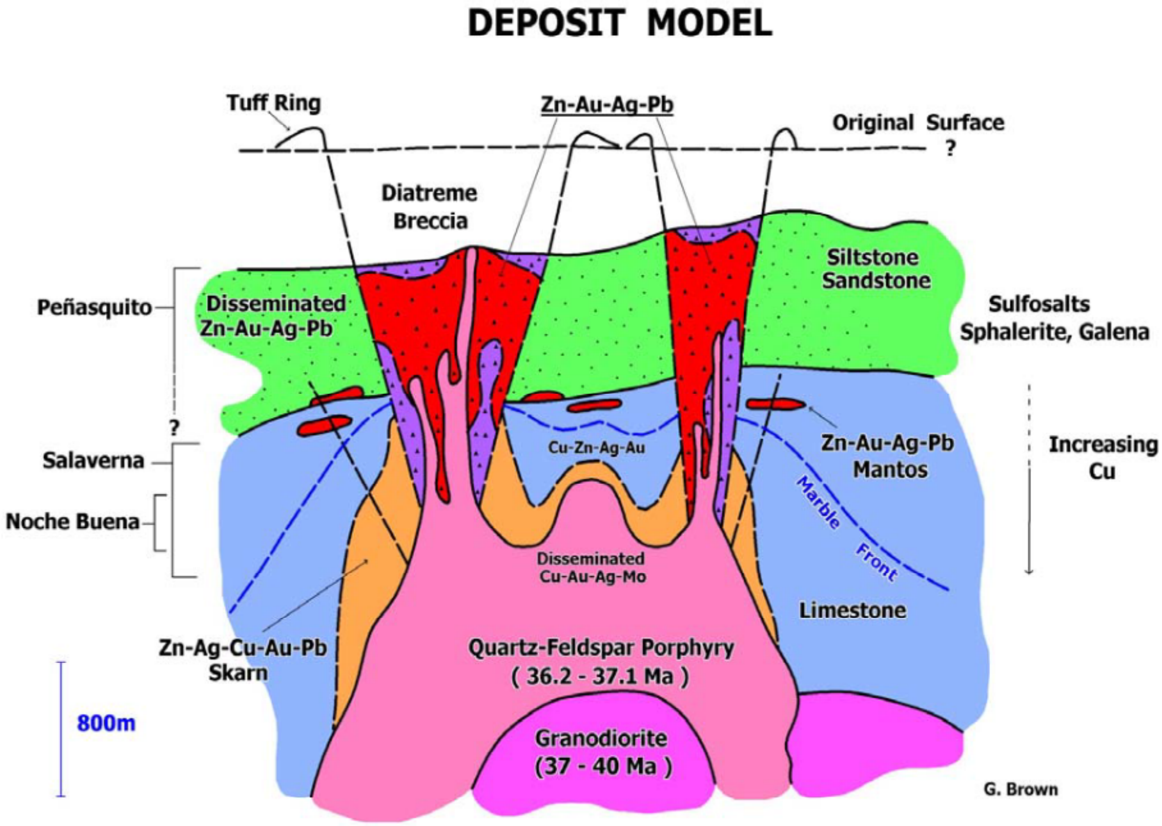
8.1 Comment on Deposit Types

In the opinion of the QPs, features which classify Peñasquito as a breccia pipe deposit include:

- Deposit location controlled by graben or cauldron-subsidence fault geometries;
- Presence of two mineralized, funnel-shaped, pipe-like, discordant breccia bodies and sheeted fracture zones at Peñasco and Brecha Azul;
- Mineralization hosted by a variety of breccia types within the breccia pipes; and by the sedimentary rocks adjacent to them;
- Concentric metal zoning;
- Large halo of sericite–pyrite–quartz–calcite alteration.

The QPs consider, therefore, that the breccia pipe model is an appropriate exploration target for the Project area. Additional exploration targets include mantos and skarn-hosted mineralization, and potentially, porphyry-related disseminated deposits.

Figure 8.1: Peñasquito Deposit Model



Note: The Noche Buena and Salaverna deposits shown on this figure are outside the Project area, and are not considered to be part of the Peñasquito Operations.

9.0 EXPLORATION

Exploration has been undertaken by Goldcorp, its precursor companies (e.g. gold exploration by Western Silver), or by contractors (e.g. geophysical surveys).

Exploration activities on the Project have included geological mapping, RC and core drilling, ground geophysical surveys, mineralization characterization studies and metallurgical testing of samples. Petrographic studies and density measurements on the different lithologies have also been carried out. Table 9-1 summarizes exploration activities other than drilling. More detailed information on the exploration programs can be found in the technical reports listed in Section 2.6.

Much of this work has been superseded by the data obtained during the drilling programs that support the Mineral Resource and Mineral Reserve estimates and by data collected during mining operations.

9.1 Grids and Surveys

The Project uses UTM NAD27. All data collected prior to establishment of the mining operation were converted to this datum.

Digital terrain data were supplied to Goldcorp by Eagle Mapping, Vancouver, Canada, from aerial photography completed 13 November 2003. Aerial photography provided a 0.24 m resolution and a vertical and horizontal accuracy of ± 1.0 m. Eagle Mapping also provided an updated topographic surface in 2008.

The last version of digital terrain data was supplied by CIVIS Inc. from its photographic flights completed on 25 May 2012. The photography covering the open pit and tailings storage facility from the 2012 flights was completed with a resolution of 0.1 m.

9.2 Exploration Potential

9.2.1 Peñasquito

During 2016, exploration drilling was focused on the edge of Peñasquito pit to test targets in three areas: La Palma, Sotol and El Puente. These areas contain sediment-hosted mineralization between and/or adjacent to the Peñasco and Brecha Azul diatremes. The results of this drilling campaign were not economic, and it was not possible to extend the open pit into these areas.

Although not actively pursued at this time, the exploration potential for deep skarn and/or manto-type mineralization is still considered important for the future of Peñasquito.

Table 9.1: Summary of Exploration Work Performed On the Peñasquito Operations

Type	Comment/Result
Geological mapping	No surficial geological mapping has been undertaken. Geological reconnaissance and drill data have shown that except for one small outcrop, the area is covered as much as 30 m of alluvium.
Open pit mapping (Goldcorp)	Geological mapping within the pit identifies lithologies and structural elements that are important for geological modeling and geotechnical considerations. This mapping is routinely compiled and used.
Geochemical sampling	The only original bedrock exposure at Peñasquito was on a single low hill in the center of what is now known as the Peñasco diatreme. Early explorers in the district collected rock-chip samples from this outcrop. The remainder of the operations area was covered by alluvium, generally 30–40 m thick, and surface sampling was not possible.
Airborne and ground-based magnetic surveys, airborne radiometric surveys, CSAMT and ground gravity and induced polarization (IP) surveys	The aeromagnetic survey defined an 8 km x 4 km, north–south-trending magnetic high which was approximately centered on the Outcrop (Peñasco) Breccia. The airborne and ground magnetometer surveys suggested the presence of deep-seated granodioritic intrusions and indicated a relationship between mineralization and the underlying plutons. Kennecott identified and defined IP chargeability and resistivity anomalies in the central Peñasquito area and the surveys were instrumental in locating the sulphide stockwork zone at the Chile Colorado. The gravity surveys identified the Brecha Azul diatreme and partially outlined the Peñasco diatreme pipe.
Airborne magnetic surveys (Goldcorp)	Included coverage of the Peñasquito and Camino Rojo blocks, in Zacatecas State. The first survey utilized a high-sensitivity aeromagnetic and FALCON Airborne Gravity Gradiometer system. This survey was flown on November 11–19, 2010, with a total of 1,789 line-km of data being acquired. The second survey used the HELITEM time domain EM helicopter system and was flown between December 11, 2010 and January 9, 2011 for a total of 1,597 line-km. The two surveys approximately covered the same areas with only modest differences in the positioning of lines. Some anomalies were detected toward the north and east of the Peñasco diatreme, which require exploration follow-up. To date, no exploration has been conducted on these anomalies.

9.3 Comments on Exploration

In the opinion of the QPs, the exploration programs completed to date are appropriate to the style of the deposits and prospects within the Operations area.

10.0 DRILLING

Drilling completed on the Peñasquito Area for the period 1994 to 30 June 2018 comprised 1,774 drill holes (853,982 m). Drill data are summarized in Table 10-1. Collar locations are shown in Figure 10-1.

Drilling has focused on the exploration and delineation of three principal areas: the Chile Colorado Zone, the Brecha Azul Zone and the Peñasco Zone.

10.1 Drill Methods

Six drilling contractors have been used:

- Major Drilling Co (core and RC);
- Adviser Drilling, S.A. de C.V. (core);
- Layne de Mexico (RC);
- BDW Drilling (core);
- KDL Mexico SA de C.V. (core);
- Boart Longyear Drilling Services-Mexico (core).

RC drilling was conducted using down-hole hammers and tricone bits, both dry and with water injection. Water flow was rarely high enough to impact the drilling, although water had to be injected to improve sample quality. Some RC drilling was performed as pre-collars for core drill holes. Sample recoveries were not routinely recorded for RC holes.

Core drilling typically recovered HQ size core (63.5 mm diameter) from surface, then was reduced to NQ size core (47.6 mm) where ground conditions warranted. Metallurgical holes were typically drilled using PQ size core (85 mm).

10.2 Geotechnical Drilling

Geotechnical drilling in support of infrastructure locations were completed as follows:

- Major Drilling Co., (Major): 2004; eight core holes completed in the area of the planned Chile Colorado pit and three core holes in the planned Peñasco pit area for a total 11 core holes (4,126 m). Core holes were oriented at an angle of 60º to the horizontal and were sited to intersect the November 2005 design basis pit wall one-third of the ultimate wall height above the base of the final pit level. Core orientation was accomplished using two independent methods: clay impression and a mechanical down-hole system referred to as Corientor™. Field point load tests were completed for each core run to estimate the unconfined compressive strength of the intact rock.

Table 10.1: Drill Hole Summary Table

Year	Project Operator	Core		Mixed*		RC		Total	
		Number Hole	Metres	Number Hole	Metres	Number Hole	Metres	Number Hole	Metres
1994–1997	Kennecott	17	5,358.31	24	13,602.44	31	5,074.70	72	24,035.45
1998	Western Copper	7	2,480.50					7	2,480.50
2000	Mauricio Hochschild	14	4,601.08					14	4,601.08
2002	Western Copper	43	18,707.19					43	18,707.19
2003		47	19,385.64	2	865.02	55	5,908.31	104	26,158.97
2004	Western Silver	123	57,726.62					123	57,726.62
2005		164	99,298.27					164	99,298.27
2006		198	114,439.73					198	114,439.73
2007	Goldcorp	194	131,007.87			23	4,942.00	217	135,949.87
2008		57	50,663.18			13	3,458.00	70	54,121.18
2009		47	21,663.72					47	21,663.72
2010		37	22,175.40					37	22,175.40
2011		23	14,648.00			59	2,495.10	82	17,143.10
2012		85	52,991.35					85	52,991.35
2013		72	43,342.20					72	43,342.20
2014		129	48,825.50					129	48,825.50
2015		101	44,854					101	44,854
2016		121	44,616			3	99	124	44,715
2017		37	9,629	5	2,068	35	7,116	77	18,813
2018 (to June-30)		6	1,723	1	138	1	78	8	1,940
Totals		***1,522***	***808,137***	***32***	***16,673***	***220***	***29,171***	***1,774***	***853,982***
*RC pre-collar with core tail									

Figure 10.1: Peñasco and Brecha Azul (Chile Colorado) Drill hole Location Map

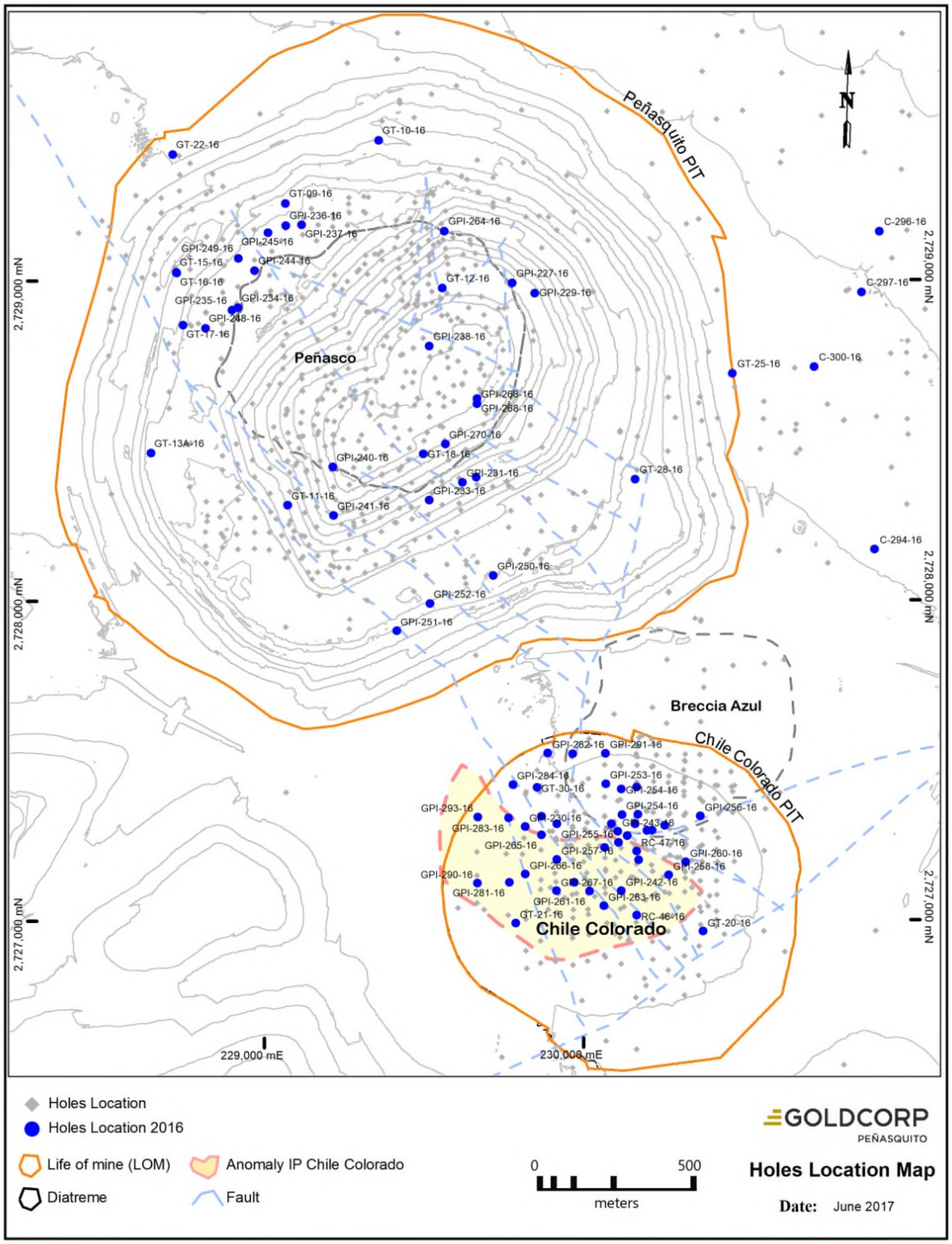


Figure prepared by Goldcorp, 2017.

Any break in the core made during removal from the barrel was marked with a “colour line”. When breakage of the core was required to fill the box, edged tools and accurate measure of pieces to complete the channels was the common practice to minimize core destruction. The end of every run was marked with a wooden tick and the final depth of the run. Core was transferred to core boxes.

All core from the Goldcorp drill programs has been processed on site. Transport of core boxes to the core shed was done by personnel from the company that was managing the drill program, or the drilling supervisor.

- Estudios Especializados de Mecánica de Suelos, S.A. de C.V. (EEMSSA), 2005: geotechnical field investigations to support the design of the heap leach facility, waste rock piles, tailings impoundment and process plant. Standard penetration tests were performed;
- Adviser Drilling, S.A. de C.V., 2010: oriented core program with seven holes (3,014.17 m) completed to provide information on the bedding orientations within the area planned for the Chile Colorado pit and identify structures that could affect the bench stability;
- Boart Longyear Drilling Services-Mexico and BDW, 2013: seven hole program (1,856.25 m), which focused on obtaining information on the bedding orientations in the north of the Peñasco pit. The drill holes were sited to provide geotechnical information for pit phase designs and for support of potential modification of pit wall slope angles in selected pit sectors. A total of 68 laboratory triaxial tests of intact rocks were performed and 52 direct shear tests to estimate the unconfined strength of the intact rock. An additional target was obtaining information on the bedding planes within the Caracol Formation. The RQD model was updated with the recent drill information, and a total of 1,211 holes were used. A total of 1,348 holes and 13 geomechanical cells were used to construct the bedding model;
- Call & Nicholas Inc., 2015: performed intact strength testing on 96 samples of core from Brecha Peñasco to determine the intact shear strength and elastic properties; these samples were taken from the 2014 drilling exploration campaign;
- Layne de México, 2015: oriented core program with eight holes (3,240.6 m), which focused on obtaining information of the bedding orientations in the north of Peñasco pit for Ph-7, Caracol Formation. These holes were sited according to SRK recommendations. SGS CIMM T&S Laboratory tested 101 samples to determine the intact shear strength and elastic properties
- Layne de México, 2016; oriented core program with nineteen holes (7,007.9 m). These drill holes were sited to provide geotechnical information for pit phase designs (Ph-7, Ph-8, Ph-9), focused on design for Final Pit.

- Layne de México, 2017; project exploration with eight holes, focused on obtaining information for north wall and instrumentation TDR, VWP's. This information was used on redesign for F6D north wall and monitoring north wall for the Macroblock instability.

10.3 Metallurgical Drilling

Metallurgical drilling was first performed in 2003–2006, with 12 holes (3,853 m) completed. Holes averaged 310 m in depth. An additional 29 core holes were drilled in 2006–2012 (15,537 m), which were typically 550 m long. During 2013, 18 holes (9,156 m) were completed, averaging 510 m in length.

During 2016, characterization of organic carbon-bearing sedimentary ores was made through reverse circulation drilling of stockpiles.

In 2018, a stockpile drilling campaign was carried out on the Stock 5 organic carbon-bearing stockpile consisting of 86 holes (3,958 m). The aim of the program was to better characterize the stockpile feed and relative deportment of carbon, gold, silver, lead, and zinc through carbon pre-flotation and the downstream metallurgical processes as the stockpile will be a significant feed source to the sulphide plant starting in the second half of 2018.

10.4 Hydrogeological Drilling

Nine water wells (8,380 m) have been completed in support of supply of the Project's water needs (Table 10-2).

Three additional holes are planned to be drilled within the Peñasquito pit during the second half of 2018.

Table 10.2: Water Wells

Well	Total Metres Drilled (m)	Year
DW-49	656	2014
DW-50	820	2014
A-3	1,744	2014
DW-51	850	2015
DW-52	850	2015
DW-53	830	2016
DW-54	520	2017
DW-55	1,050	2017
DW-56	1,060	2018

10.5 Geological Logging

Logging of RC drill cuttings and core utilized standard logging procedures. Initial logging utilized paper forms, with data hand-entered into a database from the form. Logs recorded lithologies, breccia type, fracture frequency and orientation, oxidation, sulphide mineralization type and intensity, and alteration type and intensity.

In July 2013, digital logging was implemented. Data are logged directly into acQuire using custom forms. Logs are stored on the mine server in an exploration database. Information now recorded includes lithology, alteration, minerals, structural features, oxidation description, and vein types.

Core was photographed; core photographs are retained on the mine server. Video was recorded from drill collar to toe; these digital files are stored on hard discs.

10.6 Geotechnical Logging

Geotechnical logging for pit design purposes was typically completed at 3 m intervals and recorded on CDs. For site location purposes, geotechnical logging included sample descriptions, sample numbers and visual classifications based on the united soil classification system (USCS). From 2010 onwards, all geotechnical logging has been stored in an acQuire database.

10.7 Collar Surveys

All drill hole collars are identified with a concrete monument, allowing all drill holes to be identified at a later date. The monument is placed directly over the hole collar on completion of each drill hole.

Prior to 2001, drill holes were located using chain-and-compass methods. From 2002 onwards, collar survey has been performed by a qualified surveyor. Since preparation for mining operations commenced in 2007, all surveys have been performed using differential global positioning system (DGPS) instruments. The mine currently uses Trimble R-6 GPS instruments.

10.8 Downhole Surveys

Downhole surveys are completed by the drilling contractor using a single shot, through the bit, survey instrument. Drill holes are surveyed on completion of each hole as the drill rods are being pulled from the hole. All drill holes have been downhole surveyed except the 51 Western Silver RC drill holes and 11 of the 71 Kennecott drill holes.

Use of a gyroscopic survey instrument began in 2012 when Silver State Survey (SSS) was contracted. SSS takes a measurement at 50 m intervals and at the end of the drill hole.

10.9 Recovery

Core recovery for the Peñasquito drilling programs, to end of June 2018, has averaged 98%.

10.10 Deposit Drilling

Drill hole spacing is generally on 50 m sections in the main deposits, with tighter spacing for infill drilling within the Peñasco pit. Drilling on 400 m spaced sections was undertaken in the condemnation zones and drill spacing is wider again in the areas outside the conceptual pit outlines used to constrain Mineral Resources. Drilling covers an area approximately 11 km east–west by 7 km north–south with the majority of drill holes concentrated in an area 2.1 km east–west by 2.8 km north–south.

10.11 Sample Length/True Thickness

Drilling is normally perpendicular to the strike of the mineralization. Depending on the dip of the drill hole, and the dip of the mineralization, drill intercept widths are typically greater than true widths.

10.12 Comments on Drilling

In the opinion of the QPs, the quantity and quality of the lithological, geotechnical, collar and downhole survey data collected in the exploration and infill drill programs are sufficient to support Mineral Resource and Mineral Reserve estimation as follows:

- Core logging meets industry standards for gold, silver, and base metals exploration;
- Collar surveys since 2002 have been performed using industry-standard instrumentation;
- Downhole surveys were performed using industry-standard instrumentation;
- Recovery data from core drill programs are acceptable;
- Geotechnical logging of drill core meets industry standards for planned open pit operations;
- Drilling is normally perpendicular to the strike of the mineralization. Depending on the dip of the drill hole, and the dip of the mineralization, drill intercept widths are typically greater than true widths;
- Drill orientations are generally appropriate for the mineralization style, and have been drilled at orientations that are optimal for the orientation of mineralization for the bulk of the deposit area; and
- No significant factors were identified with the data collection from the drill programs that could affect Mineral Resource or Mineral Reserve estimation.

11.0 SAMPLE PREPARATION, ANALYSES, AND SECURITY

11.1 Sampling Methods

In November 2014, Dr. Francis Pitard performed a review of sampling practices at the Peñasquito Operations. A detail sampling review was carried out covering the following processes: blast hole and drill hole sampling and quality assurance and quality control (QA/QC) procedures, exploration and ore reserve estimation, mine grade control, stockpile management, plant sampling and weighing systems, marketing concentrates, sample preparation and laboratory.

11.1.1 Geochemical Sampling

Geochemical samples were collected during early-stage exploration on the Project and are superseded by core drill and production data.

11.1.2 RC Sampling

RC drill holes completed by Goldcorp and predecessor companies were sampled at intervals of 2 m. The drill cuttings were split at the drill into several portions of 12 kg or less. A handful of rock chips from each sample interval was collected and logged by experienced onsite geologists. Data from the drill logs were entered digitally into ASCII files for computer processing.

11.1.3 Core Sampling

For all core holes drilled by Goldcorp and for most holes drilled by predecessor companies the standard sample interval has been 2 m. The only departures from this are the splitting of a 2 m interval into two portions at the overburden/bedrock contact, and in areas of low recovery, where multiples of 2 m are used to ensure that after splitting, a minimum 1 kg sample is obtained. In most cases this occurs in the upper portions of drill holes where significant weathering has occurred. Samples are marked on the inside of the boxes by a technician for the entire hole. For condemnation drill holes, one sample of 2 m was taken every 20 m unless geological inspection dictated otherwise.

Core is halved using saws. Half of the cut core is placed in the plastic sample bag and half remains in the boxes which are stored on shelves in several large, secure warehouses.

QA/QC materials are inserted by exploration staff in the dispatch portion of the sampling area. The bags are then tied with string and placed in rice bags, three per bag, the sample numbers are written on the rice bags, and they are stacked for shipment.

11.1.4 Production Sampling

Blast hole samples for submission to the on-site laboratory are collected by the Mine Geology staff using a hand held rotary drill to collect cuttings on a pre-defined pattern from the cone of cuttings. For blast holes where there is poor recovery, a larger number of sampling points is used. Samplers try to maintain an 8 kg sample size.

11.2 Metallurgical Sampling

Samples for metallurgical testwork were collected mainly from holes drilled specifically for metallurgy. Core was largely PQ diameter with lesser HQ diameter core. Samples were 2 m in length and the core was sawn, with half going for testwork, a quarter was sent to ALS Chemex for analysis, and a quarter was stored for future reference. Some additional samples were collected from old HQ core holes and rejects.

11.3 Density Determinations

During 2008 Goldcorp staff completed a total of 1,229 specific gravity (SG) measurements on drill core. An additional 127 bulk density measurements were also available from Dawson Metallurgical Laboratories Inc. Utah (Dawson 2005). SG data were then used to assign average bulk specific gravity values by lithology.

Since 2011, a standard procedure has been implemented, whereby a density sample consisting of un-split core (usually HQ), 20 to 30 cm in length, is taken every 50 m from core holes. Core is coated, and the specific gravity determined using the standard water immersion method. After testing the sample is returned to the core box. The current density database contains 6,649 determinations.

11.4 Analytical and Test Laboratories

Sample preparation and analytical laboratories used for primary analyses during the exploration programs on the Project include ALS Chemex, and Bondar Clegg (absorbed into ALS Chemex in 2001).

ALS Chemex was responsible for sample preparation throughout the Western Copper, Western Silver, and Goldcorp exploration and infill drilling phases. For much of the operations history the sample preparation facilities in Guadalajara were used; however, samples are currently prepared at the ALS Chemex facility in Zacatecas. The sample preparation facilities are not accredited. All prepared samples (pulps) are dispatched to the Vancouver, Canada laboratory facility for analysis. At the time the early work was performed ALS Chemex was ISO-9000 accredited for analysis; the laboratory is currently ISO-17025 certified. ALS Chemex is independent of Goldcorp.

Early check assays (umpire) analyses were performed by Acme Laboratories in Vancouver, which at the time held ISO-9000 accreditation. SGS Mexico (SGS) has been used for more recent check assay analyses. SGS holds ISO/IEC 17025:2005 certification. Both Acme and SGS are independent of Goldcorp.

The on-site mine laboratory is not certified and is not independent of Goldcorp.

Metallurgical testwork has primarily been completed by external laboratories, independent of Goldcorp. Metallurgical test laboratories are not typically certified. Some recent testwork has been undertaken by the on-site research laboratory, which is operated by Goldcorp personnel.

11.5 Sample Preparation and Analysis

11.5.1 Drill Sample Preparation

For the Western Copper drill programs (1998, 2002–2003), the following sample preparation was performed:

- The entire sample is passed through a primary crusher to yield a crushed product;
- Rock chips and drill samples are crushed to better than 70% passing 2.0 mm;
- A split is taken using a stainless steel riffle splitter;
- The crushed sample split weighing 250 g is pulverized using a ring and puck mill pulverizer. The pulverizer uses a chrome steel ring set. All samples are pulverized to greater than 85% passing through a 75 µm screen.

Samples of drill cuttings and drill core for programs prior to 2003 were prepared and assayed by standard procedures at ALS Chemex. The procedure, which operated between 1998 and 2003, consisted of:

- Samples were weighed and dried at 150° for about eight hours;
- Samples were crushed to 75% passing 10 mesh;
- Crushed samples were split to provide a 300 or 1,000 g representative split;
- Samples were then pulverized to 95% passing 150 mesh;
- Pulverized samples were bagged and shipped to Vancouver B.C. for analysis;
- 30 g of the pulverized samples were fire-assayed for gold.

For drill programs post-2003, the sample preparation performed by ALS Chemex was modified slightly from the pre-2003 procedure, in that:

- Crushed samples were split to provide a 250 g split;

- Samples were then pulverized to 85% passing 200 mesh.

11.5.2 Blast Hole Sample Preparation

After drying entire blast hole samples are crushed to -10 mesh and a 500 g subsample is taken using a jones splitter. A 250 g pulp is then prepared to a minimum 90% passing -200 mesh. Collection of laboratory preparation (reject) duplicates at presently is accomplished by taking the 500 g sub-sample, quartering it, and taking two sets of opposing quarters to produce an original and a duplicate each weighing 250 g.

11.5.3 Drill Sample Analysis

Table 11-1 summarizes the analytical methods used at ALS Chemex and Acme. Table 11-2 provides the detection limits for the analytical methods used.

11.5.4 Blast Hole Sample Analysis

Blast hole samples are analyzed by standard fire assay for gold and silver using a standard fire assay with an atomic absorption spectrometry (AA) finish. If the assay prill weighs more than 5 mg, a second assay is run with a gravimetric finish. Analysis for copper, lead, zinc, arsenic, antimony and cadmium are performed on a 1 g sample that is subject to a multi-acid digestion and determination by AA.

Systematic assays of blast hole samples for Organic Carbon was started in June 2016, by the LECO method with hydrochloric acid digestion.

11.6 Quality Assurance and Quality Control

11.6.1 Early Drilling Programs QA/QC

There is no information in existing documentation that confirms whether blanks and standard reference materials (SRMs) were included in the Peñasquito samples submitted for assay prior to 2002. There is, however, sufficient documentation that shows that comprehensive check-assaying campaigns were undertaken at several intervals whereby splits from samples were routinely re-assayed to confirm initial results through a separate analytical laboratory. Blanks and SRMs are reported as being used in sampling programs by Western Copper and Western Silver; however, data is not available. A set of seven SRMs was prepared in 2004 for Western Copper by Metcon Research of Tucson, Arizona from site material.

11.6.2 Goldcorp Drilling QA/QC

Since acquiring the Project in late 2006 Goldcorp has implemented QA/QC protocols on all of its drilling programs. From 2007 to the end of 2010 the programs consisted of the insertion of SRMs and blanks. Since then field duplicates have been added to the program and check assays have been carried out on samples from 2012 and 2013 drill holes.

Blanks

Two primary field blanks have been used with Goldcorp drill samples. From 2007 to 2012 crushed limestone from approximately 25 km east of the mine was used, and from 2012 to date RC cuttings from holes in areas determined to be waste rock have been used. Submittal rates have varied over the years. For 2007 and 2008, blanks were inserted once every 50 samples, from 2009 to 2011 once every 60 samples, and from 2012 to present once every 80 to 100 samples.

Table 11.1: Analytical Methods

Laboratory	Element	Method
ALS Chemex	Gold	FA-AA23; fire assay on 30 gram sample with AA finish. Much of data previously used E-GRA21; fire assay with gravimetric finish on a one-assay-ton (30 g) charge. For assays > 10 ppm ME-GRA21 is still used. AA became the primary analytical finish in 2010.
	Silver	ME-ICP41; ½-g charge digested in aqua regia acid and analyzed with an inductively coupled plasma emission spectrometer (ICP-AES); for over limits, method ME-GRA21 is used, a fire assay with a gravimetric finish on a one-assay-ton charge (30 g)
	Zinc	ME-ICP41; and for over limits method Zn-AA46 is used which is 0.4-g charge digested in aqua regia acid and analyzed by ICP-AES or inductively coupled plasma – mass spectrometer ICP-MS).
	Lead	ME-ECP41; ½ g charge digested in aqua regia acid and analyzed with ICP-AES; for over limits method Zn-AA46 is used
Acme	Gold	Group 6; fire assay with an inductively coupled plasma emissions spectrometer (ICPES) analytical finish on a one-assay-ton charge (30g).
	Silver	Group D; ½-g charge digested in aqua regia acid and analyzed with and ICPES; and for over limits Ag-AA46, which is 0.4-g charge digested in aqua regia acid and analyzed with an ICPES.
	Zinc	Group D; 1-g charge digested in aqua regia acid and analyzed with ICPES; Ag-AA46 for over limits
	Lead	Group D; ½-g charge digested in aqua regia acid and analyzed with ICPES; Ag-AA46 for over limits
SGS	Gold	GE FAA313; 30 gram fire assay with AA finish
	Silver	ICP-14B; ICP-AES. For assays>100g/t GO FAG313; 30 gram fire assay with AA finish
	Zinc	ICP14B; ½-g charge digested in aqua regia and analyzed with ICP_AES. ICP90q for over limits).
	Lead	ICP14B; ½-g charge digested in aqua regia and analyzed with ICP_AES. ICP90q for over limits).

Table 11.2: Detection Limits

Laboratory	Element	Method	Range	Overlimit Method	Range
ALS Chemex	Gold	ME-GRA21	0.05–1,000 ppm	SCR-21	0.05–1,000 ppm
	Gold	FA-AAS23	0.00	ME-GRA21	0.05–1,000 ppm
	Silver	ME-ICP41	0.2–100 ppm	ME-GRA21	5–10,000 ppm
	Zinc	ME-ICP41	2–10,000 ppm	Zn-AA46	0.01–30%
	Lead	ME-ICP41	2–10,000 ppm	Pb-AA46	0.01–30%
Acme	Gold	G601	0.005–10 ppm		
	Silver	G1D	0.3–100 ppm	8AR	1–1,000 ppm
	Zinc	G1D	1–10,000 ppm	8AR	0.01–30%
	Lead	G1D	3–10,000 ppm	8AR	0.01–10%
SGS	Gold	GE FAA313	0.005–10ppm		
	Silver	GE ICP14B	2–100ppm	GO FAG313	10–5,000 ppm
	Zinc	GE ICP14B	1–10,000 ppm	ICP90Q	0.01–30%
	Lead	GE ICP14B	2–10,000 ppm	ICP90Q	0.01–30%

In general, these blanks have performed well in monitoring for contamination; however, both blanks have a number of unexplained failures that suggest the material used is occasionally weakly mineralized.

Standard Reference Materials

Goldcorp has used two series of SRMs. In 2007 seven SRMs were prepared for Goldcorp by Metcon Research of Tucson, Arizona, from composited Peñasquito drill core. They covered a range of gold, silver, lead and zinc values, and were used mainly from 2007 to 2009.

In late 2009, eight SRMs, also multi-element and covering a range of grades, were prepared by SGS in Durango from mineralization collected from the 1910 and 1895 benches in the Peñasco open pit. These standards are still currently in use, with rotating sets consisting of a high-grade and low-grade SRM each.

As with blanks, submittal rates have varied over the years. From 2007–2008 SRMs were inserted every 30 samples, from 2009–2010 every 60 samples, from 2011–2014 every 40 samples, and currently every 20 to 80 samples.

Results for the Metcon SRMs generally displayed very good assay accuracy, although there were a number of weak biases relative to the expected values, mainly weak high biases.

The SGS SRMs also generally show good assay precision but similarly show weak biases, mainly for lead and zinc. Such biases relative to expected values are not unusual.

In each set of SRMs, from both Metcon and SGS, there were a higher than expected number of failures for standards with low gold grades (<0.50 g/t gold) where a fire assay with gravimetric finish was used. This assay method has a high (0.05 g/t gold) detection limit and typically shows poor assay accuracy for gold values of less than 1.0 g/t gold. As such there is risk that assay accuracy for gold in Peñasquito drill hole samples at low gold grades, where a gravimetric finish was used, is poor. Results for analyses using an AA finish show good assay accuracy at low gold grades.

Duplicates

Since 2011, quarter-core field duplicates have been used and inserted every 60 to 80 samples. In September 2015, a change was made to submitting ½ core duplicates. Results to date indicate good assay precision.

Check Assays

At total of 652 pulps from the 2012 and 2013 drilling programs were submitted to SGS in 2014 for check assay. Results show negligible bias for gold and silver while SGS displays weak low biases for lead and zinc relative to ALS Chemex.

Ore Control QA/QC

Ore control has been inserting field duplicates from its blast holes as well as blanks. Assay precision as determined by the duplicates is good. Ore Control acquired suitable blank material from limestone outside of the mine in March 2016. SRMs were implemented in July 2016.

Check assays are sent regularly to ALS Chemex. ALS Chemex does display weak to moderate high biases relative to the mine laboratory for gold, silver, lead and zinc, mainly at higher grades for the latter two.

On-Site Mine Laboratory QA/QC

The on-site laboratory uses pulp blanks in its fire assay runs and has included quartz washes in sample preparation in the past. The laboratory is not currently using any washes but is planning to reinstate them. Results from the pulp blanks indicates no problems with contamination.

RockLabs gold SRMs are inserted once every 30 sample assay run and show good assay accuracy. Multi-element SRMS are planned to be added to the program, including some prepared from Peñasquito material.

The laboratory prepares reject duplicates every 20 samples and regularly runs pulp replicate analyses. Both show good assay precision.

The mine laboratory also regularly sends pulps for check assay to ALS Chemex with results displaying similar high biases by ALS Chemex to those displayed by the ore control check assays.

11.7 Databases

Entry of information into databases has utilized a variety of techniques and procedures to check the integrity of the data entered. Geological data from early drill programs were entered into spreadsheets in a single pass. It is not known what kind of database was used prior to 2009.

All drill data from 2007 to July 2013 was entered from paper logging forms into Excel files before being imported into acQuire. Since July 2013, logging and recording of other drill hole data by geologists and technicians has been directly into acQuire on laptop computers, with the data subsequently imported into the main database.

Assays received electronically from the laboratories are imported directly into the database. Analytical certificates received since 2010 have been stored in the database and were validated via the acQuire software.

Data are verified on entry to the database by means of built-in program triggers within the mining software. Checks are performed on surveys, collar co-ordinates, lithology data, and assay data.

Paper records have been archived for all assay and QA/QC data, geological logging and bulk density information, down-hole and collar coordinate surveys. All paper records were filed by drill-hole for rapid location and retrieval of any information desired. Assays, down-hole surveys, and collar surveys were stored in the same file as the geological logging information. Sample preparation and laboratory assay protocols from the laboratories were also monitored and kept on file.

Exploration data are appropriately stored on a mine server, and data are regularly backed up by the mine information technology (IT) department.

11.8 Sample Security

Sample security was not generally practiced at Peñasquito during the exploration drilling programs, due to the remote nature of the site. Sample security relied upon the fact that the samples were always attended or locked at the sample dispatch facility. Sample collection and transportation have always been undertaken by company or laboratory personnel using company vehicles.

Current practice is for drill core to be collected form the drill rig by Goldcorp employees and delivered to the secure exploration facility in the town of Mazapil, 12 km east of the mine where it undergoes logging and sampling. Sample shipments are picked up once a week by a truck from ALS Chemex and taken to one of their preparation facilities. In the past they were sent to Guadalajara but currently they are prepared in Zacatecas. After preparation they are sent by air to the ALS Chemex analytical facility in North Vancouver, B.C for analysis.

Chain of custody procedures consist of filling out sample submittal forms that are sent to the laboratory with sample shipments to make certain that all samples were received by the laboratory.

11.9 Sample Storage

After sampling core is stored in secure facilities in Mazapil for future reference. Some core is stored on steel shelves within the secure exploration facility, and some core is stored in secure warehouses a short distance away. As far as is possible core is stored in numeric sequence by drill hole number and depth.

Sample rejects and pulps are returned by ALS Chemex to Goldcorp's core shack in Mazapil for storage. Coarse rejects in plastic bags are stored in cardboard boxes on steel racks in a separate locked building and are labelled and stored by sample number. Weathering has deteriorated the integrity of individual rejects and pulps from earlier drill programs.

11.10 Comments on Sample Preparation, Analyses, and Security

In the opinion of the QPs, quality of the drill, sampling and analytical data are suitable to support Mineral Resource and Mineral Reserve estimation and mine planning, based on the following:

- Data are collected following industry-standard sampling protocols;
- Sample collection and handling of RC drill cuttings and core was undertaken in accordance with industry standard practices, with procedures to limit potential sample losses and sampling biases;
- Sample intervals in core and RC drilling, comprising maximum of 2 m intervals respectively, are considered to be adequately representative of the true thicknesses of mineralization. Not all drill material may be sampled depending on location and alteration;
- Density determination procedures are consistent with industry-standard procedures;
- There are sufficient acceptable density determinations to support the density utilized in waste and oxide and sulphide mineralization tonnage interpolations for the key deposits;
- Sample preparation has followed a similar procedure since 2003. The preparation procedure is consistent with industry-standard methods for polymetallic deposits;
- Exploration and infill core and RC programs were analysed by independent accredited laboratories using industry-standard methods for gold, silver, and base metal analysis. Current run-of-mine sampling is performed by the on-site mine laboratory, which is staffed by Goldcorp personnel. The on-site mine laboratory is not accredited;

- There is limited information available on the QA/QC employed for the earlier drill programs; however, sufficient programs of reanalysis have been performed that the data can be accepted for use in estimation;
- Drilling programs have typically included the insertion of blank, duplicate and SRM samples. The QA/QC program results do not indicate any problems with the analytical results, therefore the gold, silver, and base metal analyses from the core drilling are suitable for support of Mineral Resource and Mineral Reserve estimation;
- Sample security has relied upon the fact that the RC and core samples were always attended or locked in the logging and sampling facility. Chain-of-custody procedures consist of filling out sample submittal forms that are sent to the laboratory with sample shipments to make certain that all samples are received by the laboratory;
- Production blast hole samples are only handled by site staff and on-site laboratory personnel and do not leave the mine area; and
- Current sample storage procedures and storage areas are consistent with industry norms.

12.0 DATA VERIFICATION

A number of independent data checks have been performed in support of preliminary assessment, pre-feasibility, and feasibility studies on the Project. Goldcorp performed sufficient verification of the data and database to support Mineral Resources and Mineral Reserves being estimated.

12.1 Internal Verification

12.1.1 General

Validation checks are performed by operations personnel on data used to support estimation comprise checks on surveys, collar coordinates, lithology data, and assay data. Errors noted are rectified in the database.

12.1.2 Legacy Exploration Data

Three different databases are in use at the mine site:

- Mapinfo dataset; compiled historic assay tables in Excel, with lithology data;
- Resource dataset; pre-2010 resource database with appended 2011 data manipulated in Excel from acQuire exports;
- acQuire database for current logging.

A review of the datasets indicated that there were some extremely high copper values especially in historic WC series drilling, and that the 2013 acQuire database might not contain a full set of historic assay records due to data loading errors during the original implementation of the acQuire system in 2008–2009.

Goldcorp was provided with permission to download from the assay laboratory, the original assays from the Western Copper and Western Silver programs. Subsequently, the 2012 and 2011 drill data sets were reviewed for completeness of historic drill information, and any missing data were entered into acQuire. Comments were added to the collar information as required. All other legacy (pre-Goldcorp) data have been carefully reviewed and verified by Goldcorp personnel.

The revised historic assay data in the database are now considered to reflect the information in the downloaded assay certificates and are suitable for use for exploration targeting and construction of geological models.

12.2 External Verification

12.2.1 SNC Lavalin (2003)

SNC Lavalin reviewed:

- Results of a check assay program completed in November 2002 for a total of 277 samples from drill holes WC17 and WC33 analyzed by both ALS Chemex and Acme. The analysis of values above the detection limit showed differences between the laboratories, with the ALS Chemex mean grade higher than the Acme results;
- Results of a check assay program completed by ALS Chemex and Acme on a total of 184 samples from drill holes WC42 to WC52. Differences between mean grades for the original samples and their checks varied from -1.3% for lead to 8.7% for gold, which was considered a very good agreement;
- Review of six Excel spreadsheets that were provided on 15 March 2003 with SRM assays for Kennecott drilling; SNC Lavalin noted some ambiguities regarding these standards and comments included in the files indicated to SNC Lavalin that not all results were completed. No additional work was performed on these data;
- Review of an Excel spreadsheet file with SRM assays for the Hochschild drill program. The results of the SRMs displayed a reasonable correlation. Differences between average assay values varied from –6.5% to 4.3%.

SNC Lavalin analyzed a set of SRM results for the 1998 and 2002 Western Copper drilling; the SRMs displayed a reasonable correlation.

SNC Lavalin audited a portion of the database (approximately 10%) with the original assay laboratory certificates making a direct comparison between tables when possible. A total of 1,812 samples were selected randomly, covering all phases of drilling up to drill hole WC60. Checks included drill hole intervals, sample numbers, gold, silver, copper, lead, and zinc grades. The error rate detected was less than 1.0%, which was considered to be a good agreement for mineral resource estimation purposes.

SNC Lavalin collected six samples from the core library for independent analysis. The samples included both high-grade and waste material as identified by historical analytical results and were analyzed by ALS Chemex. In general, the differences between the original results and the quartered core were higher than expected, particularly for the MHC series drill holes.

12.2.2 Independent Mining Consultants (2005)

As part of feasibility-level studies, Independent Mining Consultants (IMC) undertook a database review.

Based on a review of Western Silver's sample preparation, analysis, security, and QA/QC procedures with respect to database verification, the database used for the resource estimates was deemed by IMC to be accurately compiled and maintained and was accepted as suitable for use in Mineral Resource estimation.

IMC also concluded that no significant problems were identified during reviews of the drilling data. The drill holes appeared to have been properly located and downhole surveyed and to have recovered an adequate sample.

Data entry errors were considered to be minimal because IMC re-compiled the bulk of the assay data base directly from the original laboratory's electronic files of assay certificates.

IMC concluded that check assay comparisons showed generally acceptable overall agreement between the primary and check laboratories for all of the campaigns/phases for which check assays were available. Standard and blank assaying results also appeared to be generally acceptable. IMC concluded that some silver assays performed by ALS Chemex during the later Western Silver phases may be biased 5–15% low as a result of analytical factors, but this bias could not be confirmed at the time of the report, and IMC concluded that the errors introduced into NSR value estimates would be minimal.

IMC supplemented the check assay data by performing numerous paired comparisons of grades from different drilling and assaying campaigns, including those for which no check assays are available. The results showed no evidence that any of the Western Silver and Kennecott assays were affected by large analytical or sample preparation biases. However, they did suggest that the Hochschild grades were positively biased relative to the Kennecott and Western Silver grades for gold, silver and zinc. No Hochschild samples were available for re-assay; the Hochschild assays were not used when estimating grades in the feasibility-study model.

The paired-comparison reviews did not detect any biases between core and RC drilling.

12.2.3 Mine Development Associates (2007)

In April 2007, Mine Development Associates (MDA) of Reno, Nevada performed an independent analytical review of the Peñasquito check assay data up to and including Phase 17 drilling (the last hole incorporated was GP-377). MDA concluded that the analytical work performed on the gold, silver, lead and zinc of the Peñasquito database could be relied upon for resource estimation (MDA 2007), and commented that:

- A bias was noted between Acme and ALS Chemex gold analytical results, with Acme assays being lower in tenor. The bias was considered to be real and definitive but occurred in only selected drill campaigns. Overall, there was an excellent correlation and similar mean grades between ALS Chemex and Acme. In spite of this, MDA noted extreme variability decreasing with increasing grades. MDA were unable to confirm if this was caused by problems in sub-sampling the aliquot for assaying, inaccuracies in analytical procedures, or natural material heterogeneity. MDA recommended additional work so as to optimize sub-sampling and analytical procedures for future production. The lack of reproducible assays was noted to be likely to lead to unavoidable and blind production losses that could be economically significant;

- There was inconsistent evidence with respect to different laboratory and analytical methods concerning bias in silver values. While the ALS Chemex ICP grades were generally high and the ALS Chemex "ore-grade" assays were generally low, the biases noted could be offsetting. Relative to the SRM grades, ALS Chemex was found to be high at low grades and low at high grades. MDA commented that reproducibility was not good under any circumstances and should be addressed in future studies. MDA recommended that the analytical procedures be addressed in detail by a geochemist in advance of production so as to obtain the most dependable analytical method for production, as the impact of incorrect data during production could be potentially very large;
- A case could be made that the ICP values are low, thereby imparting a small conservative bias to the zinc data but it cannot be stated definitively. If the database zinc values are low, then they could by low by 1–5%. The reproducibility of zinc grades based on analytical work and sub-sampling the aliquot for analysis, was considered to be good for the "ore-grade" data and marginal to poor for the ICP data, suggesting that the problem is contributed by ICP analysis, not sub-sampling the aliquot. MDA recommended that during grade control, when precision is substantially more important, further work should be considered to determine which method is better;
- Lead data in the database were found to be biased low when compared to both sets of "ore-grade" analyses and against the SRM grades, but the Acme ICP lead values were lower grade than the grades returned from the ALS Chemex ICP data. Reproducibility of lead grades based on analytical work and sub-sampling the aliquot was considered good for the "ore-grade" data and marginal to poor for the ICP data. MDA recommended that during grade control, when precision is substantially more important, further work should be considered to determine which method is better.

12.2.4 P&E Mining Consultants (2008)

P&E Mining Consultants (P&E) of Brampton, Ontario, reviewed the performance of the Goldcorp quality control program which was implemented after the MDA 2007 audit (P&E 2008). Drill holes included in the P&E review included Phase 18 holes GP-493 to GP-586 drilled in 2007 and 2008. Results of the review included the following:

- Reduce the number of SRMs from seven to three and aim to monitor cut-off grade, resource grade and a grade that reflects the highest grades likely to be encountered on the Project;
- Evaluation of the performance of the SRMs revealed failures. A total of 39 certificates were affected and 400 samples were reanalyzed from drill holes GP-493 to GP-586. Generally all data that were rerun were in excellent agreement with the first set of data, and the original results were retained in the database;
- For coarse reject duplicates, results demonstrated acceptable precision: from 32% to 44% for gold, 18% to 23% for silver, 19% to 20% for lead and 16% to 18% for zinc.

12.2.5 Hamilton, 2014

Andrew Hamilton P.Geo., an independent consultant hired by Goldcorp, performed a study between April and September 2014 to verify the quality of the assay data through a review of the QAQC results and procedures. No significant issues were identified by Mr. Hamilton; furthermore, most of the issues identified during his study were addressed while Mr. Hamilton was on site. As a result, the database is considered of sufficient quality to support Mineral Resource estimation.

12.3 Comments on Data Verification

Goldcorp has established internal controls and procedures on their mining operations and exploration programs, which are periodically reviewed for effectiveness. These are considered by the QP to be supportive of data verification.

The process of data verification for the Project has been performed by external consultancies and Goldcorp personnel. Goldcorp considers that a reasonable level of verification has been completed, and that no material issues would have been left unidentified from the programs undertaken.

The QP, who relies upon this work, has reviewed the appropriate reports, and is of the opinion that the data verification programs undertaken on the data collected from the Project adequately support the geological interpretations, the analytical and database quality, and therefore support the use of the data in Mineral Resource and Mineral Reserve estimation, and in mine planning:

- Inspection of all laboratories are undertaken on a regular basis to ensure that they are well maintained and that all procedures are being followed properly. Deficiencies or concerns are reported to the laboratory manager;
- Sample biases identified from the QA/QC programs undertaken are not considered material to estimation;

- Updates have been made to historic assay drill data, in particular to assays from the Western Copper/Western Silver programs, based on original assay certificates from the analytical laboratory. The revised historic assay data in the database are now considered to accurately reflect the information in the original assay certificates, and are acceptable for exploration targeting and construction of geological models;
- QA/QC data is monitored closely and detailed reports are prepared on a monthly basis. Assay data needs to be approved before import in to the database;
- Drill data including collar co-ordinates, down hole surveys, lithology data, and assay data are typically verified prior to Mineral Resource and Mineral Reserve estimation by running program checks in both database and resource modelling software packages; and
- External reviews of the database have been undertaken in support of acquisitions, support of feasibility-level studies, and in support of technical reports, producing independent assessments of the database quality. No significant problems with the database, sampling protocols, flowsheets, check analysis program, or data storage were noted.

13.0 MINERAL PROCESSING AND METALLURGICAL TESTING

Over the Project history, a number of metallurgical testwork campaigns have been undertaken. These are summarized in Table 13-1. These test programs were sufficient to establish the optimal processing routes for the oxide and sulphide ores, performed on mineralization that was typical of the deposits. The results obtained supported estimation of recovery factors for the various ore types.

13.1 Metallurgical Testwork

13.1.1 Mineralogical Studies

Mineralogical studies have been performed in order to increase the knowledge of the different ore types in the mine, targeted to ensure the best possible treatment for each ore category, and maximize the recovery.

Mineralogical analysis of concentrate indicates that the lead concentrate consists mainly of galena with lesser amounts of bournonite; tetrahedrite–tennantite is the main carrier of copper into the lead concentrate. The lead flotation circuit also recovers significant amounts of the associated silver and gold-bearing minerals into the lead concentrate, mainly as electrum, native gold, native silver, and hessite, as well as other minor mineral species. The zinc concentrate is basically a very clean product where sphalerite is the main zinc mineral species. A small amount of silver is present as a solid solution in tetrahedrite–tennantite crystals associated with sphalerite.

Gold deportment studies carried out in 2015 on Peñasquito flotation tails indicate that 80% of the gold that was not recovered into either of the two concentrates was present in association with pyrite. For the recovery of gold and silver, this mineralization responded best to a combination of bulk pyrite flotation + cyanide leaching. Use of gravity concentration was not considered viable as the gold is disseminated as very small particles within the pyrite matrix. Within the flotation tails, gold particles up to a maximum of 15 µm in size have been identified, but they are generally significantly smaller. Gold primarily occurs as a gold–silver telluride (51%), less commonly as a lead–gold–silver telluride (31%), and the remainder less frequently in the form of electrum and native gold. Approximately 45% of the gold occurs on the surface of pyrite grains, 45% is locked within the pyrite grain, and the balance occurs as free gold-bearing particles. This indicates that flotation will recover significant amounts of the gold (and silver), but that the leaching of the pyrite concentrate will result in the incomplete extraction of the gold and silver unless fine grinding of the concentrate is employed.

Further mineralogical studies were also carried out in 2016 and 2017 to understand the grain size and association of organic carbon hosted in sedimentary ores.

Table 13.1: Metallurgical Testwork Summary (Historical)

Testing Facility	Testwork Performed
Hazen Research, Golden Colorado, USA	Mineralogy shows that tetrahedrite and tennantite are the main carriers of impurities such as Cu into concentrates. Antimony always exceeds the arsenic levels so the main contaminants are closer to tetrahedrite in composition. Zinc in Zn concentrate is in the form of sphalerite. 80% of gold and silver recovered in the MP flotation circuit were associated with pyrite. Best results to recover the gold and silver were achieved by bulk pyrite flotation + cyanide leaching. Gravity concentration does not work due to gold dissemination into pyrite. Gold particles are 15 µm or less in size. Gold occurs as 51% gold–silver telluride, 31% as lead–gold–silver telluride and 15% as electrum. 45% of the gold is exposed on the surface of pyrite grains, 45% is locked in pyrite and 10% occurs as free grains.
Instituto de Metalurgia, UASLP, San Luis Potosi, México	Mineralogical analysis of copper, lead and zinc concentrates showed that tetrahedrite and tennantite crystals are the main carrier of Cu (90–100 %); bournonite and jamesonite are present in minor quantities (0–10 %). Lead in lead concentrates is in the form of galena and minor quantities of lead sulphosalts such as bournonite. The zinc content into lead concentrates is mainly due to chemically bonded zinc in tetrahedrite–tennantite crystals. Pyrite concentrate shows that gold and silver are mainly present as tellurides (calaverite and hessite) exposed and occluded in pyrite crystals. The main gangue is formed by quartz, potassium feldspars and calcite.
FLSmidth Knelson, British Columbia, Canada	Gravity-recoverable gold (GRG tests). Tests consisted of extended gravity recoverable gold (E-GRG) & two-pass GRG test for fresh feed and rougher lead concentrate respectively. For fresh feed overall GRG recovery of 21.4% was achieved. For two-pass GRG after two stages of overall GRG, the recovery was 7.16%.
Hazen Research, Golden Colorado, USA	214 samples from 24 drill holes were submitted for hardness characterization at Hazen (SMCT, A, b, Mia, ta, BWi, DWi, ai, RWi, UCS) and SGS (SPI); 60 samples from Peñasco; 112 samples from Caracol Seds; 42 samples from Chile Colorado (refer to Section 7 for deposit and lithology descriptions)
Minera Peñasquito, Metallurgical Laboratory	Open and closed-circuit flotation test for different ore types as well as bottle and column cyanide leaching test on transitional ore.
	On January 2012 the metallurgical department in Peñasquito started leaching tests on monthly composites of zinc tails from the Sulphide Plant exploring the possibility of recovering gold and silver values that were non-recoverable in the lead and zinc circuit. Tests consisted of bottle leaching of zinc tails without regrinding, with 850 and 1,500 ppm of NaCN, pH 11 and a ratio solid / liquid 1:2, during a 72 hours period. From these initial results it was determined that the recovery of Au and Ag was possible from zinc tail, however given the tonnage for zinc tails leaching the entire stream was not economical.
Hazen (Golden, Colorado)	Commissioned in 2013 to preform mineralogy by Quantitative Evaluation of Minerals by Scanning electron microscopy (QEMScan) to determine specifically which mineralogical species were associated with the precious metal. The mine had already preliminarily linked the gold and silver with the iron and arsenic which was indicative of the association of gold and silver in pyrite. The results of this study confirmed that over 80% of gold observed was associated with pyrite. The gold and silver were present mainly as tellurides (85 %) and electrum (15%). This study indicated that it may be possible to perform a sulphide flotation to produce a pyrite concentrate with good gold and silver recovery into approximately 10% of the mass of the zinc tails.
Kemetco (Richmond, British Columbia)	Concentrate Enhancement Project. Lead–copper separation flotation tests at laboratory scale and pilot plant scale. A process was developed that would produce clean lead and copper concentrates, a saleable antimony product and a stable arsenic residue. The project was not advanced due to favourable concentrate marketing terms for complex lead-copper concentrates.

Minera Peñasquito, Metallurgical Laboratory	Pyrite flotation testwork was conducted during 2013 and 2014 with the objective of recovering the gold and silver from the pyrite concentrate. The concentrates were reground and leached, and detoxification tests were conducted on the tailings.
ALS Metallurgy (Kamloops, British Columbia, Canada)	Testwork commenced in March 2015 to confirm the results obtained from the Minera Peñasquito work. Testwork included a mineralogical evaluation, flotation kinetics and cell design parameters, flowsheet definition, and leach response with regrind size, slurry density, leaching time, reagent consumption values, and organic carbon effects. A sample mass of 8 t was used to compile yearly composite samples (based on the current mine plan at the time the testwork was carried out).
Surface Science Western (London, Ontario, Canada)	Two samples of different lithology were studied during 2015, in order to characterize the gold deportment and the nature of the organic carbon present.

13.1.2 Physical Characteristics

In order to determine crushing and grinding parameters, a total of 214 drill core samples from 24 metallurgical drill holes were submitted to the Hazen Research facility in Golden, CO to determine the physical characteristics of the ore. These samples represented all lithologies scheduled to be encountered during mining, including breccias and intrusive rocks from the Peñasco and Brecha Azul pipes, and sedimentary rocks of the Caracol Formation adjacent to Peñasco and in the Chile Colorado deposit area.

The program completed included the following tests: semi-autogenous grinding (SAG) mill comminution (SMC) testing as developed by SMC Testing Pty Ltd (SMCT); the JK breakage parameters A and b, abrasion breakage (ta), tumbling mill index (Mia), abrasion index (Ai), drop weight index (DWi), Bond ball mill work index (BWi), Bond rod mill work index (RWi), and unconfined compressive strength (UCS) tests.

The hardness parameters have been used to estimate the throughput in the milling circuit using specialized simulation studies. A summary of the key parameters is presented in Table 13-2. The lithological units in the table are described in Section 7.

Table 13.2: Hardness Characteristics

Orebody	Lithology	Concept	Hardness SAG Mill		Hardness Ball Mill
			A*b	Ta	A*b
Peñasco	QFP	Minimum hardness	38.00	0.37	17.20
		Average hardness	37.55	0.38	18.65
		Maximum hardness	37.10	0.38	20.10
	BXI	Minimum hardness	87.53	0.34	11.40
		Average hardness	47.91	0.51	13.43
		Maximum hardness	33.50	0.94	15.90
	BXM	Minimum hardness	59.50	0.46	11.90
		Average hardness	50.76	0.53	13.50
		Maximum hardness	43.10	0.63	15.90
Caracol	KUC	Minimum hardness	43.04	0.33	12.10
		Average hardness	34.82	0.39	17.00
		Maximum hardness	28.07	0.50	22.20
Chile Colorado	KUC (SS)	Minimum hardness	40.80	0.29	11.20
		Average hardness	34.01	0.35	15.74
		Maximum hardness	28.40	0.41	22.30
Brecha Azul	BXM	Minimum hardness	123.30	0.48	9.30
		Average hardness	84.85	0.87	11.45
		Maximum hardness	46.40	1.25	13.60
	BXI	Minimum hardness	141.50	0.44	11.20
		Average hardness	82.79	0.84	12.40
		Maximum hardness	43.30	1.43	13.10
	IBX	Minimum hardness	29.00	0.29	15.50
		Average hardness	29.00	0.29	15.50
		Maximum hardness	29.00	0.29	15.50
	QFP	Minimum hardness	31.00	0.27	11.70
		Average hardness	29.50	0.30	12.10
		Maximum hardness	28.00	0.32	12.50

13.1.3 Gravity Testwork

Two samples of fresh feed to the sulphide plant and rougher lead concentrate were taken and sent to FLSmidth Knelson in B.C., Canada, (refer to Table 13-1) to complete gravity testwork in order to test the amenability of the ore to gravity concentration.

Results did not support gravity recovery as a viable option, and the Peñasquito flowsheet does not incorporate a gravity circuit.

13.1.4 Special Mineralization Types

Since the early start-up of operations, metallurgical testing has been performed on a daily basis for all ores that have been feed to the mill. These daily tests have been aimed to capture the expected performance of the ore in the sulphide plant to determine in advance any change in the reagent scheme or in the impurity levels into the final concentrates. Historically, this resulted in identification of a number of different ore types. Current understanding of ore characterization and variability has simplified classification to sediment and diatreme ores and the relative content of organic carbon.

13.1.5 High-Carbon Ores

Two potential processes have been considered for mitigation of the impact of processing high-carbon ores; chemical depression and pre-flotation. Industrial plant trials carried out in 2016 confirmed operational challenges associated with treating high-carbon ores with a carbon depressant alone. Organic carbon floated to a significant extent which volumetrically overwhelmed the lead cleaner circuit, lead and zinc flotation kinetics were impacted such that some lead was recovered in the zinc circuit and significant zinc was lost to the zinc tails. Overall reagent consumption was very high and concentrates produced were of lower value due to reduced gold and silver grades in the lead concentrate.

Continued batch and locked-cycle testwork as well as a continuous mini-pilot plant led to the decision to advance the carbon pre-flotation process, as providing a superior metallurgical result as compared to chemical addition alone. Design and engineering for the CPP plant began in 2016 and the plant was commissioned during the second quarter of 2018.

13.1.6 Carbon Pre-Flotation Process (CPP)

A significant amount of testwork has been carried out to evaluate the pre-flotation process for feeds with high organic carbon. This includes a large number of batch tests carried out at the metallurgical laboratory at the Peñasquito site; as well batch testing at AuTec in Vancouver, BC; batch and locked cycle testing at Blue Coast Research in Parksville, BC; and batch and pilot plant testing at XPS in Falconbridge, ON.

Peñasquito Laboratory – Batch Testing

A series of 53 batch tests were carried out at the metallurgical laboratory at the Peñasquito site. The samples were drilled from the Stock 5 stockpile. The tests included milling and sequential flotation of a pre-flotation rougher, lead rougher, zinc rougher, and pyrite rougher.

A complex flotation suite incorporating frothers, depressants, activators, and collectors was evaluated. An initial test charge was floated at site before each of the test to help determine flotation conditions and reagent dosages. Head grades for samples from Stock 5 showed in average: 0.34 g/t Au, 30.16 g/t Ag, 0.44% Pb and 0.75% Zn.

AuTec Laboratory – Batch Testing

A series of tests were carried out at AuTec to evaluate carbon pre-flotation, including cleaning of the pre-flotation rougher concentrate and the screening of several organic carbon depressants. A total of 650 kg of ore was received from Peñasquito; which was crushed to 2 mm, homogenized, and split into charges. Fire assay, sulphur and carbon speciation analysis showed in average: 0.49 g/t Au, 34.6 g/t Ag, 1.86% C_{tot}, 0.18% C_{org}, 1.68% C_{inorg}, 3.9% S_{tot} and 3.87% S^{2-}. Significant values of gold, silver and organic carbon were found in the -11 µm size section and a quarter of the total carbon (TCM) material was found in the +150 µm size fraction.

Pre-flotation tests showed that the use of collectors during flotation increases the recovery of Au, Ag, Pb and Zn to the pre-flotation concentrate without increasing the recovery of organic carbon, therefore the pre-flotation should be carried out with the use of frother only. The carbon reported in the concentrate belonged to the fine fraction.

The use of depressants (NaCN and DepreZn) did not result in beneficial results.

Peñasquito Plant Trials

A series of plant trials with high organic carbon feed were carried out at Peñasquito. The purpose of these trials was to evaluate the plant performance at high carbon feed with the use of a carbon depressant (Cromalux 251) and high reagent dosages. Trials were carried out during June 2016.

The plant was fed material consisting of a blend of stockpile material from Stock 5 and Stock Lutitas as well as fresh feed. The head grade averaged 0.29% C_{org}, 0.19 g/t Au, 0.40% Pb, and 0.72% Zn. During the plant trial, it was observed that flotation kinetics across the lead and zinc rougher were slowed down so that very little froth was being collected from the front end of the circuit. Significant concentrate was being collected at the back end of the roughers cells. In the cleaning circuit, mainly for lead, the froth became very persistent, and significant overflowing of cells, feed tanks, and pump boxes occurred. Analysis of the results from the plant trial showed that increased lead was being recovered in the zinc circuit and significant zinc was being lost to the zinc tails. As a major part of the gold follows the lead recovery, gold recovery to the lead concentrate was very low, depleting the overall concentrate value.

Therefore, plant trials concluded that the use of depressants and increased levels of reagents was an insufficient mitigation strategy against organic carbon in the flotation circuit. Current plant could not handle large fluctuations of organic carbon due to inoperable conditions in the cleaning circuits. After plant trials, pre-flotation became the focus of efforts to mitigate TCM on flotation.

Blue Coast Research Testing

A large bulk sample of stockpile ore was sent to Blue Coast for flotation testwork. The material had a head grade of 0.43 g/t Au, 31.8 g/t Ag, 0.49% Pb, 0.80% Zn, 3.56% Fe, and 0.19% organic carbon.

A locked cycle cleaning test (LCT) was carried out to assess the performance of a two-stage cleaning process, whereby the pre-flotation rougher concentrate would be cleaned by a single stage of conventional cleaning following by re-cleaning in a column flotation cell. Figure 13.1 illustrates the flowsheet that was used.

Based on a pre-flotation rougher mass pull of 4.7%, with results from the fourth and fifth cycles, the re-cleaner concentrate had a mass pull of 0.2%, leaving 4.5% as the mass pull of the cleaner-scavenger tail. The rougher concentrate had a slurry solids density of 10.1%, as compared to the re-cleaner concentrate at 3.8%. Table 13-3 is an example of the mass pulls obtained, the grades and the distribution of species of interest between the re-cleaner concentrate, the cleaner scavenger tail, and the rougher tails that return to existing process as feed to the lead circuit.

Figure 13.1: Carbon Pre-flotation Process – Locked Cycle Evaluation

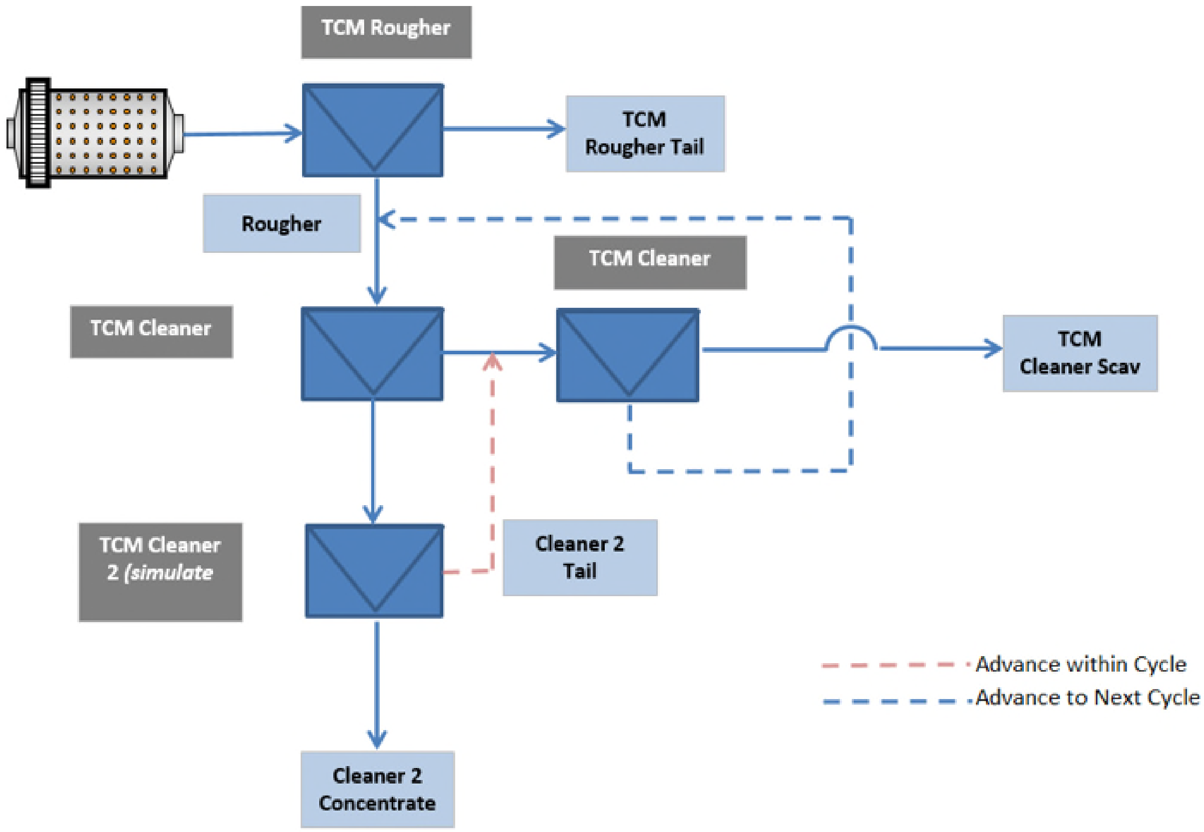


Table 13.3: Example Mass pull and Product Grades from Re-Cleaner LCT

Product	Mass Pull (%)	Assays					
		Pb (%)	Zn (%)	Fe (%)	Au (g/t)	Ag (g/t)	C_{org} (%)
Re-Cleaner Concentrate	0.2	1.8	0.44	3.02	12.30	522	18.65
Cleaner Scavenger Tail	4.5	0.59	0.65	2.22	0.83	46	0.35
Pre-flotation Rougher Tail	95.3	0.45	0.78	3.53	0.37	30	0.12

Results indicated that with typical grades of 12.3 g/t Au and 522 g/t Ag (and 18.7% C_{org}), the re-cleaner concentrate could be a high-value product, treatment of which led a separate investigation and development of the Tertiary Precious Metals Recovery Project (summarized in Section 13.1.7).

Expert Process Solutions (XPS)Testing – Pilot Plant

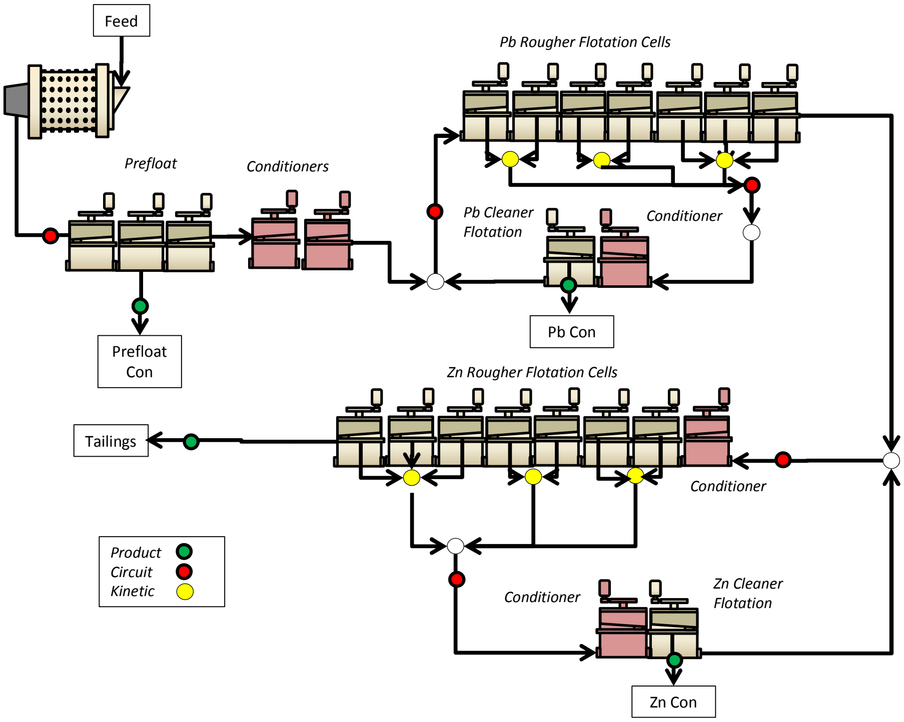
A continuous pilot plant was carried out by XPS, with two feed samples being tested. The primary objective was to observe the impact of pre-flotation on the downstream lead and zinc flotation circuits.

Two bulk samples were tested: Stock 5 and CV02. Stock 5 is a composite sample made up of selected drilled samples from Stockpile 5 that were high in carbon and were gold-bearing. CV02 is a conveyor belt sample from feed to the plant from May 29, 2016. The pilot plant incorporated a continuous pre-float rougher flotation, lead rougher and first cleaner flotation, and zinc rougher and first cleaner flotation. Average reconciled head assays and associated standard deviations are presented in Table 13.4 and the pilot plant configuration in presented in Figure 13.2.

Table 13.4: Reconciled Head Assys

Sample	Au (g/t)	Ag (g/t)	C_{org} (%)	Pb (%)	Zn (%)	Fe (%)
CV02	0.22 ± 0.02	27.57 ± 1.90	0.30 ± 0.04	0.38 ± 0.04	0.70 ± 0.05	3.88 ± 0.15
Stock 5	0.37 ± 0.01	32.67 ± 1.37	0.30 ± 0.02	0.37 ± 0.02	0.63 ± 0.04	4.30 ± 0.20

Figure 13.2: Pilot Plant Configuration for Carbon Pre-Float, Lead, and Zn Flotation



The pilot plant was run from October 31 to November 3, 2016. and operating conditions were varied to test operation with and without pre-flotation, as well as pre-flotation with and without the addition of a chemical depressant. Additionally, for Stock 5, the effect of moving the depressants into the mill was also assessed.

For a 2016 plant sample, overall flotation performance was improved with pre-flotation showing higher Pb recovery into the Pb concentrate and higher Zn recovery into the Zn concentrate. Approximately 27% of the C_{org} reported to the pre-flotation concentrate and around 63% C_{org} reported to the zinc sulphide tails. The addition of depressant following pre-flotation did not improve overall results significantly.

Without pre-float, lead recovery was smeared across into the zinc concentrate although depressant effectively depressed organic carbon to the zinc tails. Higher gold, lead, and zinc losses were observed to the zinc tails for the scenario without pre-float and with depressant addition.

13.1.7 Tertiary Precious Metals Recovery

As discussed in section 13.1.6, the Tertiary Precious Metals Recovery Project was investigated as a potential add-on to the carbon pre-flotation process to assess the possibility or re-capturing metal values contained in the carbon concentrate generated by the CPP.

A number of process options were evaluated and subsequently ruled out for application due to challenges associated with processing large volumes of dilute slurry made up of ultrafine particles. Ultrafine gravity concentration was found to be a promising technology based on the ability to handle slurry at the pulp density produced from the re-cleaner column and its ability to reject lower SG-material (i.e. organic carbon) and retain higher SG-material. Initial UF Falcon testing was performed in 2016 on CPP rougher concentrates produced on a lab scale. The three test samples were:

- Sample 1: La Morena CPP Rougher Concentrate, generated at Blue Coast from a number of batch flotation tests
- Sample 2: Stock 5 CPP Rougher Concentrate prepared in October 2016 at XPS in a CPT pilot plant to access the benefits of CPP
- Sample 3: CV02 CPP Rougher Concentrate prepared in October 2016 at XPS in a CPT pilot plant to access the benefits of CPP in October 2016

In December 2016, the samples were sent to Met-Solve laboratories where UF Falcon concentrator tests were performed. The objective of the testing was to evaluate the recovery of gold, silver and sulphides in the concentrate, while rejecting organic carbon to tailing. Sample 1 was run at 150 G's while samples 2 and 3 ran at 220 G's. A summary of the test results are as follows:

Table 13.5: Summary of Initial UF Falcon Testwork

Recovery to Falcon Concentrate								
Sample	**Gold**		**Silver**		**Total Sulphur**		**Total Carbon**	
	Head (g/t)	**UF Rec (%)**	**Head (g/t)**	**UF Rec (%)**	**Head (wt%)**	**UF Rec (%)**	**Head (wt%)**	**UF Rec (%)**
1	1.29	75.6	73	59.4	2.16	61.8	2.99	15.5
2	2.65	62.0	267	69.8	4.55	72.5	3.76	14.2
3	0.46	43.3	33	56.5	2.08	77.8	3.31	20.8

To validate the process on the final CPP cleaner column concentrate, it was necessary to reconfigure an on-site flotation pilot plant and add a column cell. The re-cleaner column used for the initial CPP pilot was a 6" unit rented from COREM in Quebec City, Quebec.

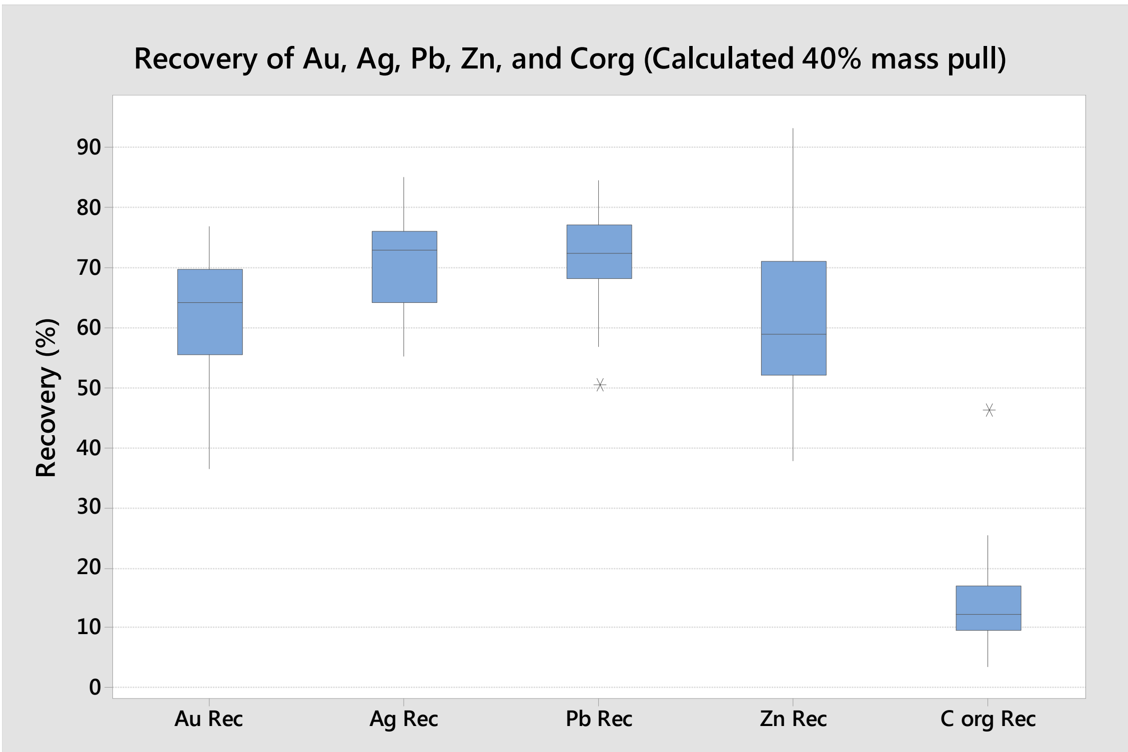
The feed to the pilot plant was a high carbon material sourced from Stockpile 5 at Peñasquito. Three totes of re-cleaner column concentrate with a 5% pulp density were sent to Met-Solve in July 2017. Samples from tote 1 were used for the initial tests. These tests were performed at 220 G's to be consistent with previous testwork.

To better assess the applicability of the ultrafine Falcon technology, a fully integrated pilot plant was operated at site. Forty variability tests were conducted on intermediate samples for technology verification of the UF Falcon process.

At 40% concentrate mass yield, the gold and silver recoveries from the column concentrate Falcon tests ranged from 51-75% gold, 56-79% silver, and organic carbon rejection was 85-92%. There is no indication that head grade or operating conditions impacted gold and silver recoveries. Results were generally positive regardless of the industrial plant parameter test conditions.

Figure 13-3 summarizes the results for the Falcon tests for all samples (column concentrates and intermediate streams), demonstrating the concentration of precious and base metals while rejecting most of the organic carbon.

Figure 13.3: Recovery of Au, Ag, Pb, Zn and C_{org} from CPP Concentrates



Particle size analyses were conducted in conjunction with UF Falcon testing to determine the impact of low particle size on recovery. The cut-off for recovery has been estimated to be about 4 – 5 µm. The concentrates produced were determined to have a particle size P_{80} in the range of 10 – 52 µm in the rougher concentrates, 7 – 11 µm in the cleaner concentrates, and 7 – 13 µm in the column concentrates. Based on the results, the material from all the samples was sufficiently coarse and recoveries were positive.

13.1.8 Pyrite Leach Process (PLP)

As noted in Section 13.1.1, some gold associated with pyrite is currently lost to tails. Goldcorp carried out an extensive investigative program to determine whether it is economically viable to recover pyritic gold from final tails. The pyrite leach process will be an add-on to the existing Peñasquito sulphide processing plant consisting of: flotation of final zinc tails to produce a rich gold-silver-pyrite concentrate; pre- and post-cleaner concentrate re-grind; pre-leach flotation and concentrate leaching. This section discusses the metallurgical testing executed for this project.

Flotation

To investigate recovery of gold from flotation tails, variability tests were performed at the Minera Peñasquito metallurgical laboratory as indicated in Table 13-6 and Table 13-7. Mineralogical work on a number of concentrate samples were performed to help better understand the flotation results seen in the laboratory.

All the testwork was performed at a reasonably large scale, with rougher and scavenger flotation in a 28 L cell and cleaning in a 4.5 L cell.

The results of this test program support the following key design parameters:

- 12 minutes of rougher flotation;
- Regrind of the +125 µm fraction of the rougher concentrate to improve liberation of the pyrite from the gangue minerals;
- 6 minutes of cleaner flotation;
- Mass pull of 6 – 12% depending on iron grade.

Recovery is typically 85% of the pyrite contained in the zinc tails, which contains roughly 75% of the residual gold, depending on head grade, along with approximately 70% of residual silver.

Gold and silver grades reporting to leach will fluctuate with ore type, metal grades, and pyrite content.

Table 13.6: Variability Testwork Program – Diatreme Ore

Tests	Sample
Variability - 175 open circuit rougher tests	Fresh pulp from the zinc tail of the full scale sulphide plant, at the actual PSD, % solids and pH of plant
Variability - 141 open circuit cleaner tests	Rougher concentrate from variability open circuit tests
30 closed circuit tests to evaluate optimum circuit configuration: 2 tests to evaluate cleaning of combined rough and scavenger flotation concentrates; 11 tests to evaluate cleaning of a rougher concentrate with scavenger concentrate recycled to the rougher; 17 tests to evaluate regrinding and cleaning of a rougher concentrate with scavenger concentrate recycled to the rougher.	Fresh pulp from the sulphide plant zinc tail, at the actual PSD, % solids and pH of plant

Table 13.7: Variability Testwork Program – Sediments (Peñasco and Chile Colorado)

Tests	Sample
86 composites from Peñasco 52 composites from Chile Colorado	18 drill cores were obtained from MP Exploration Department for sediments strategic located in mineralized areas of the mine from of Peñasco (11 core holes) and Chile Colorado (7 core holes). Lithology, alteration, oxidation and chemical analysis were performed every 2 m and metallurgical composites were prepared according mineralization, lithology, alterations and oxidation keeping all composites within the same geological characteristics and spatially identifiable, without mixing between different core holes.

Leaching

As part of the evaluation process of gold and silver recovery from zinc tails, composites were made from the concentrates generated during the variability testing in pyrite flotation and were used in leaching tests in the Minera Peñasquito laboratory.

Results of these tests showed that optimal recovery was achieved at:

- Leaching of pyrite concentrates at pH of 11;
- Regrind of pyrite concentrates to P_{80} of 20 µm;
- 24 hour leach

ALS Metallurgy, Kamloops, B.C., and Surface Science Western Testwork

Both flotation and leaching testwork were conducted in an extensive test program designed to confirm the processing parameters established during the previous testwork.

For this program, an 8 t sample of half-drill core and assay rejects was used to produce seven yearly composite samples, three lithology composite samples, and a Master

Composite sample for conducting the basic scoping tests. The yearly composite samples were constituted according to the existing mine plan plant feed for the years 2018 to 2024.

Each composite sample was assayed for gold, silver, sulphur, iron, total organic carbon, as well as copper, lead, zinc, arsenic, antimony, total carbon, zinc oxide and lead oxide. The range of selected head data included:

- 0.33–0.81 g/t gold
- 17–49 g/t silver
- 3.59–5.41% sulphur
- 3.2–4.2% iron
- 0.01–0.16% total organic carbon.

The lithology samples constituted a breccia and intrusive rock sample, a sedimentary low organic carbon sample, and a sedimentary high organic carbon sample. Each composite sample was processed in the pilot plant to generate sufficient pyrite concentrate sample material for the investigative testwork following the Peñasquito plant processing steps producing lead and zinc concentrates and a zinc flotation tailing. The zinc tailing was subsequently processed to produce a pyrite flotation concentrate. The pyrite flotation concentrates produced were subsequently leached with cyanide for gold and silver recovery. The pyrite concentrate chemical composition created from the master composite was 1.62 g/t Au, 55 g/t Ag, 31.6% Fe and 36.7% S.

Gold deportment analysis confirmed that the majority of the gold was visible, and lesser amounts as colloidal-sized gold inclusions with minor solid solution gold. The flotation and leaching testwork results confirmed the design criteria previously determined, including the optimal regrind size as 20–24 µm, a slurry density of 45% solids, and a leaching time of 28 hours. The energy requirements for the regrinding steps were also determined by testing suitable products. Alternative flowsheet configurations were also tested ultimately leading to the selection of the flowsheet which included the following main steps:

- Rougher flotation stage;
- Using the initial rougher concentrate as final product pyrite concentrate;
- Regrinding the following rougher concentrate;
- Cleaner flotation of the reground rougher concentrate;
- Return of the cleaner tailings to the mid-circuit of the rougher circuit;
- Regrinding the initial rougher concentrate and the cleaner concentrate;
- Leaching the reground concentrate following a pre-aeration stage;
- Using a counter-current decantation circuit to produce the pregnant solution;

- Using the Merrill-Crowe process to recover gold and silver; and
- Employing a detoxification step of the tailings prior to discharge to the tailings storage facility.

Grind Size Effect

As expected, the test results from the Master Composite sample indicated that a finer grind resulted in higher extraction values for gold and silver. However, it was established that the difference between the extraction values in the particle size range of interest, namely for P80 values from about 18 to 24 microns, was not significant.

Preg-Robbing Effect

The leaching tests also highlighted that preferential blinding of gold, "preg-robbing", occurred during the leaching process, and that the extent of the preg-robbing losses was dependent on the amount of organic carbon present in the sample, and the amount of exposed surface area of the organic carbon which was available for adsorption of the dissolved gold (and silver to a lesser extent). The two lithology samples studied indicated that the nature of the organic carbon was a highly-disordered carbon structure with a large surface area, indicating a high capacity for preg-robbing.

Preg-robbing mitigation tests were also conducted indicating that, for samples within the range of organic carbon studied, the extent of preg-robbing could be reduced. CIL tests were also performed on a number of samples to evaluate preg-robbing effect and predict the Au and Ag extraction under preg-robbing conditions. Others test included the addition of Kerosene, sodium lauryl sulphate (SLS), and petroleum sulphonate as blinding agents to mitigate the preg-robbing effect. All three agents have been confirmed as effective blinding agents of active organic carbon sites to varying degrees.

Carbon in Leach (CIL) Test

The gold recovery through flotation, leach and CIL on the seven annual and three lithology-based composites varied from 64-87%, with an average of 74%. The impact of leaching without mitigating gold preg-robbing was apparent in this work. To mitigate preg-robbing, an allowance for up to two blinding reagents has been included in the new plant design.

Silver recoveries from ten composites were evaluated. Flotation recovery for silver was lower than for gold, ranging from 47 to 82%, with an average of 68%. Silver leach recovery was less impacted by preg-robbing and ranged from 57% to 88% with an average of 79%.

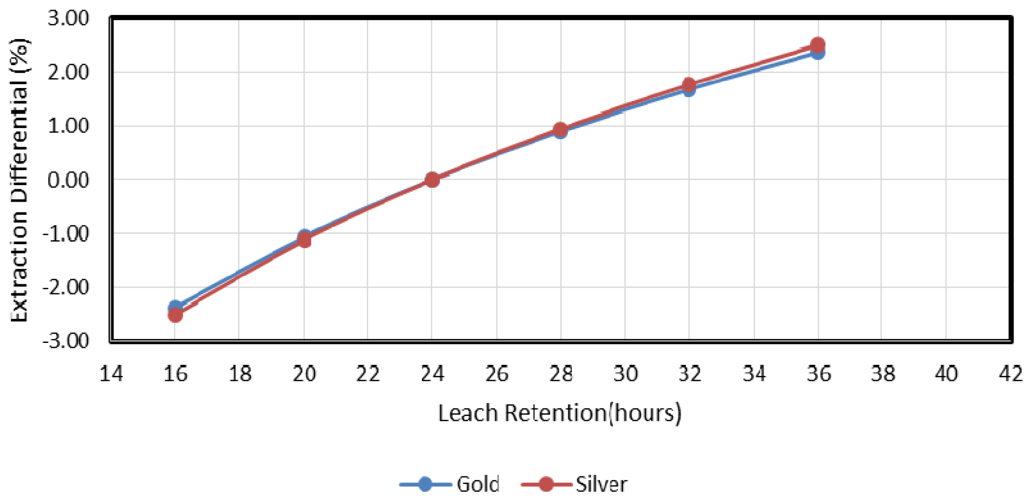
Impact of Process Parameters on Recovery

During flotation, silver recoveries improved with increasing retention time on rougher and cleaner flotation. Recovery of gold was improved with increasing retention time in cleaner flotation but this effect was less apparent during rougher flotation since gold floated more quickly than silver.

During leaching, the leach retention time and grind size had a noticeable impact on gold and silver recovery. For gold, leach recovery falls by about 1% when the grind goes from 20 microns to 25 microns. The drop is higher for silver at about 1.6% over the same size range. The benefit of extended leach time can be seen in Figure 13.4, where an increase in 4 hours from 24 to 28 hours would expect to give an additional 1% leaching for both gold and silver.

During the design process (Feasibility Study), economic trade-offs were applied to optimize the final design.

Figure 13.4: Impact of Leach Retention Time on Au and Ag Recovery



The overall recovery in the pyrite leach circuit is therefore dependant on a number of variables, and will be expected to be about 35-40% for gold and 45-50% for silver on average. Testwork results provided the basis for process and equipment design of the PLP area. The projected production plan for the Peñasquito PLP circuit is from 2018 to 2027. Section 17 of this report presents the plant description and major mechanical equipment considered in the design of the PLP circuit.

13.2 Metal Recovery Estimates

13.2.1 Sulphide Plant

The mineralogical complexity of the Peñasquito ore makes the development of models difficult as eight elements (gold, silver, lead, zinc, copper, iron, arsenic, and antimony) are tracked through the process, and the models need to be robust enough to allow for changes in mineralogy and plant operations while giving reasonably predictions of concentrate quality and tonnage.

Until the third quarter of 2013, the metallurgical model used to predict recovery in the sulphide plant at Peñasquito was a fixed-recovery model. This fixed-recovery model evolved from the 2006 feasibility study, which used average recoveries based on lithology for the main elements (gold, silver, lead and zinc). The first update, developed in the third quarter of 2013, differs from those proposed in the feasibility study as they were modified to better fit the plant performance data for normal ores and metallurgical testwork data for low-lead ores. A second update was introduced in 2015.

A further update to the metallurgical recovery models was carried out in 2017. The updated models incorporate grade-recovery relationships and the impact of organic carbon on all ore types. Based on the updated 2017 metallurgical recovery models, the forecasted LOM average recoveries prior to the start-up of the PLP are:

- Gold: 59.5%
- Silver: 78.6%
- Lead: 75.0%
- Zinc: 79.1%

Following the completion of the PLP, the forecasted LOM average recoveries are:

- Gold: 72.3%
- Silver: 87.6%
- Lead: 75.0%
- Zinc: 79.1%

All stated recoveries exhibit short-term variability, for all ore types, around the average recoveries.

13.2.2 Oxide Plant

The gold and silver recovery has stabilised over the period that the mine has been in operation. Average recovery in Peñasquito oxides plant for years 2015 and 2016 has been 57% and 56.7% respectively for gold, and 24.6% and 24.4% respectively for silver. Forecasted recoveries are based on historical averages and for gold are 59.0% and 25.5% for silver. New material and heap irrigation was interrupted at the oxide plant in 2017 and subsequently restarted in 2018.

13.3 Metallurgical Variability

The metallurgical models for Peñasquito are based on evaluation of plant data and development of relationships incorporating recovery and head grades. Correction factors for organic carbon and its impact on all ore types were implemented in the 2017 recovery model update. When reviewing plant performance against model predictions the models have less variability than the plant operation, as expected, and overall recovery predictions are in-line with plant performance.

13.4 Deleterious Elements

The mineralogy at Peñasquito is incredibly diverse. Galena and sphalerite are the main payable minerals, with a host of complex sulphosalts (including tennantite and tetrahedrite) also reporting to the concentrates. These sulphosalts can carry varying amounts of deleterious elements such as arsenic, antimony, copper and mercury.

At the effective date of this Report, the processing plant, in particular the flotation portion of the circuit, is not able to separate the copper-bearing minerals from the lead minerals, so when present the sulphosalts report (primarily) to the lead concentrate.

The marketing contracts are structured to allow for small percentages of these deleterious elements to be incorporated into the final product, with any exceedances then incurring nominal penalties. Historically, due to the relative small proportion of concentrate bearing high levels of deleterious elements, the marketing group has been able to sufficiently blend the majority of the deleterious elements such that little or no financial impact has resulted.

Within the metallurgical models used at Peñasquito, copper recovery to lead concentrate varies from 55–75%, with 10–15% copper recovery into zinc concentrate. Due to the close mineralogical association, arsenic and antimony recovery to concentrate is based on a relationship to the copper in the concentrate. The future impact of the deleterious elements is thus highly dependent on the lead–copper ratio in ores.

Mercury is not included in the metallurgical models as it is not included in the mine plan. One small area of the mine (located within a narrow fault zone that is hosted in sedimentary rock in the southwest of the pit) has been defined as containing above-average mercury grades. Due to its limited size, blending should be sufficient to minimise the impact of mercury from this area on concentrate quality.

Organic carbon has also been recognized as a deleterious element affecting the recovery of gold and the operational cost in the process plant. The carbon pre-flotation process was built to allow for removal of liberated organic carbon ahead of lead and zinc flotation so that those process steps could operate in a similar fashion to operation with low-carbon ores.

13.5 Comments on Mineral Processing and Metallurgical Testing

In the opinion of the QPs:

- Metallurgical testwork programs were sufficiently detailed to establish the optimal processing routes for the oxide and sulphide ores and were performed on mineralization that was typical of the deposit. The results supported the estimation of recovery factors for the various ore types;
- Metallurgical testwork programs are adequate to understand the expected ore variability and plant optimization potential.

- Future gold and silver recovery from the heap leach circuit are predicted to be about 57% for gold and 24% for silver based on historical recovery rates. If the mill feed constituents or the blend changes, the mine will have to revisit the recovery expectations;
- Additions being made to the process, including CPP and the Tertiary Precious Metals Recovery process, will enhance the ability to process high-carbon ores
- The PLP will recover additional silver and gold that would otherwise deport to the zinc tails
- One small area of the mine has been defined as containing above average mercury grades. Due to its limited size, blending should be sufficient to minimise the impact of mercury from this area on concentrate quality; and
- Additional variability testwork is being undertaken on sedimentary rocks in the Peñasco and Chile Colorado pits, and the testing of various reagents and techniques to mitigate the effect of organic carbon in the ore.

14.0 MINERAL RESOURCE ESTIMATES

The cut-off date for assays in the database was 26 February 2017. The database contains core drilling information from numerous drilling campaigns beginning in the 1990s through to December 2016. Drill hole data that support Mineral Resource and Mineral Reserve estimation were collected in the period from 1994 to 26 February 2017.

MineSight was used for compositing and grade interpolation. The final block model was compiled in a MineSight project.

14.1 Geological Models

Three-dimensional (3D) solids were created from drill hole data, geological cross sections and plans using Leapfrog software. A 3D surface, representing a mapped fault, was used to divide the model into a north and south domain.

Six sets of geologic models (six sets of solids) were used to control interpolation and/or to control subsequent recovery and NSR calculations:

- Oxidation model (Figure 14-1);
- Lithology model (Figure 14-2);
- Alteration model (Figure 14-3);
- Grade shell model (Figure 14-4 to 14-7-);
- Organic carbon model (Figure 14-8);
- Fault block domains (Figure 14-9).

Figure 14.1: Oxidation Model, Looking East

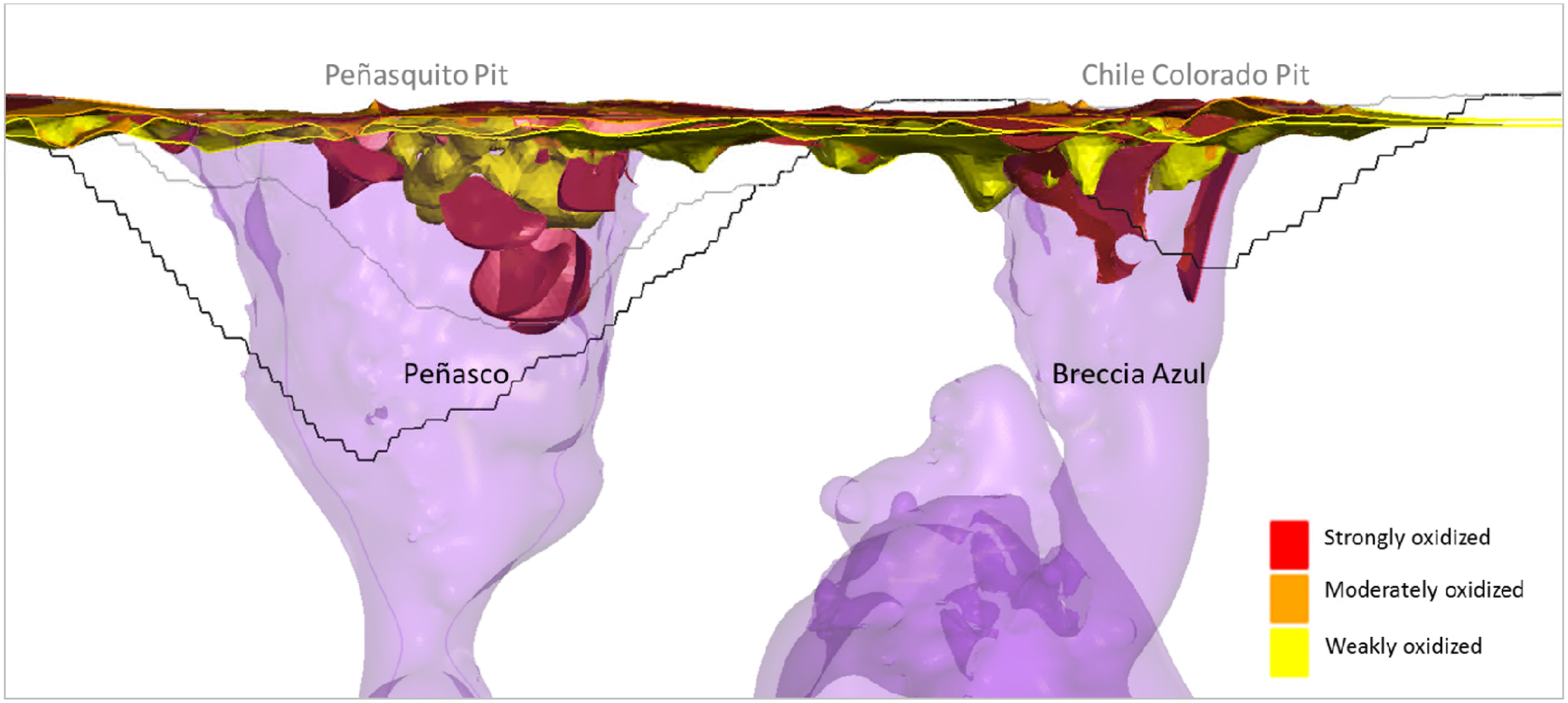


Figure prepared by Goldcorp, 2017. Horizontal distance across figure is approximately 4 km.

Figure 14.2: Lithology Model, North Oblique View

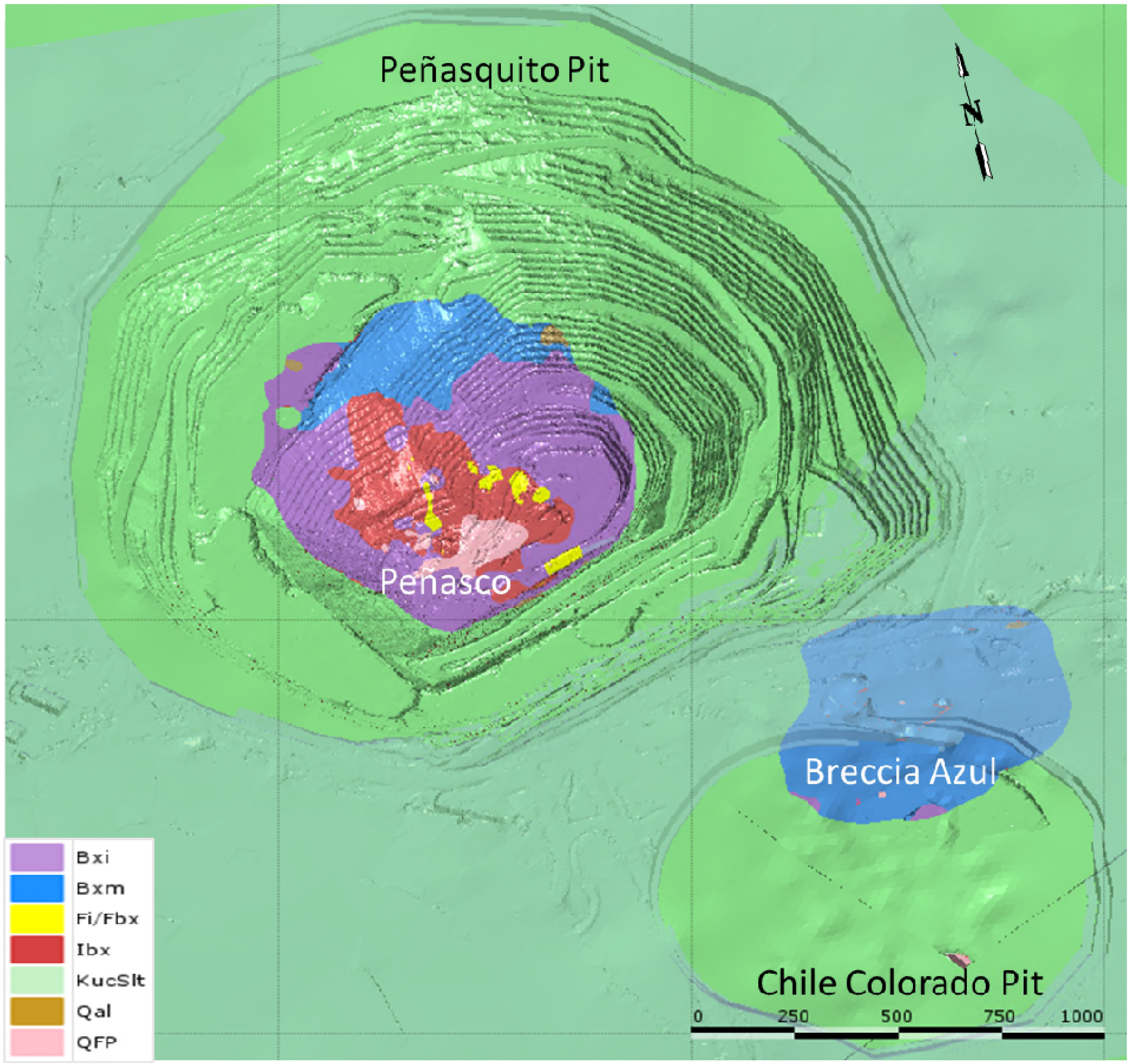


Figure prepared by Goldcorp, 2017.

Figure 14.3: Alteration Model, North Oblique View

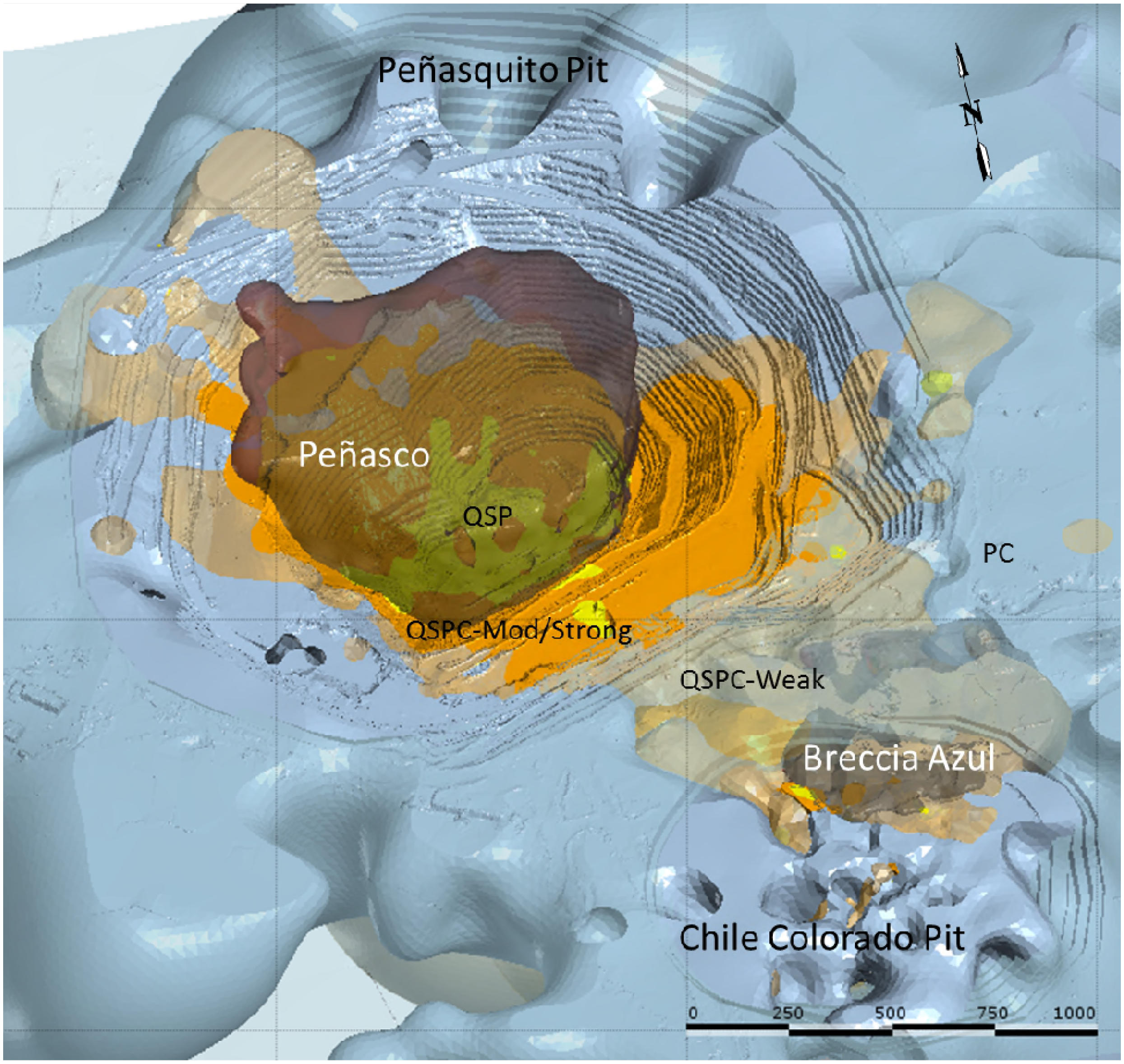
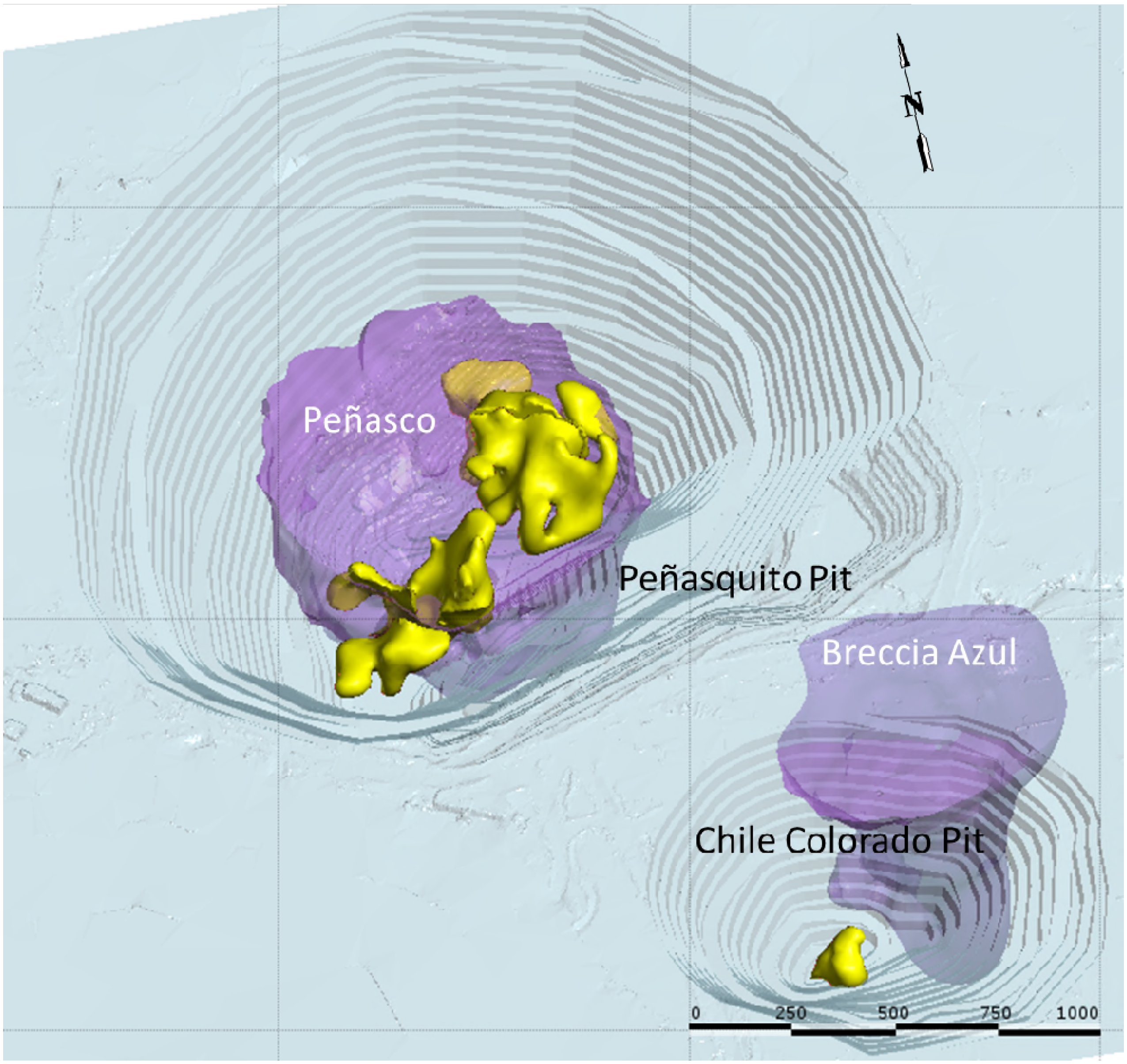


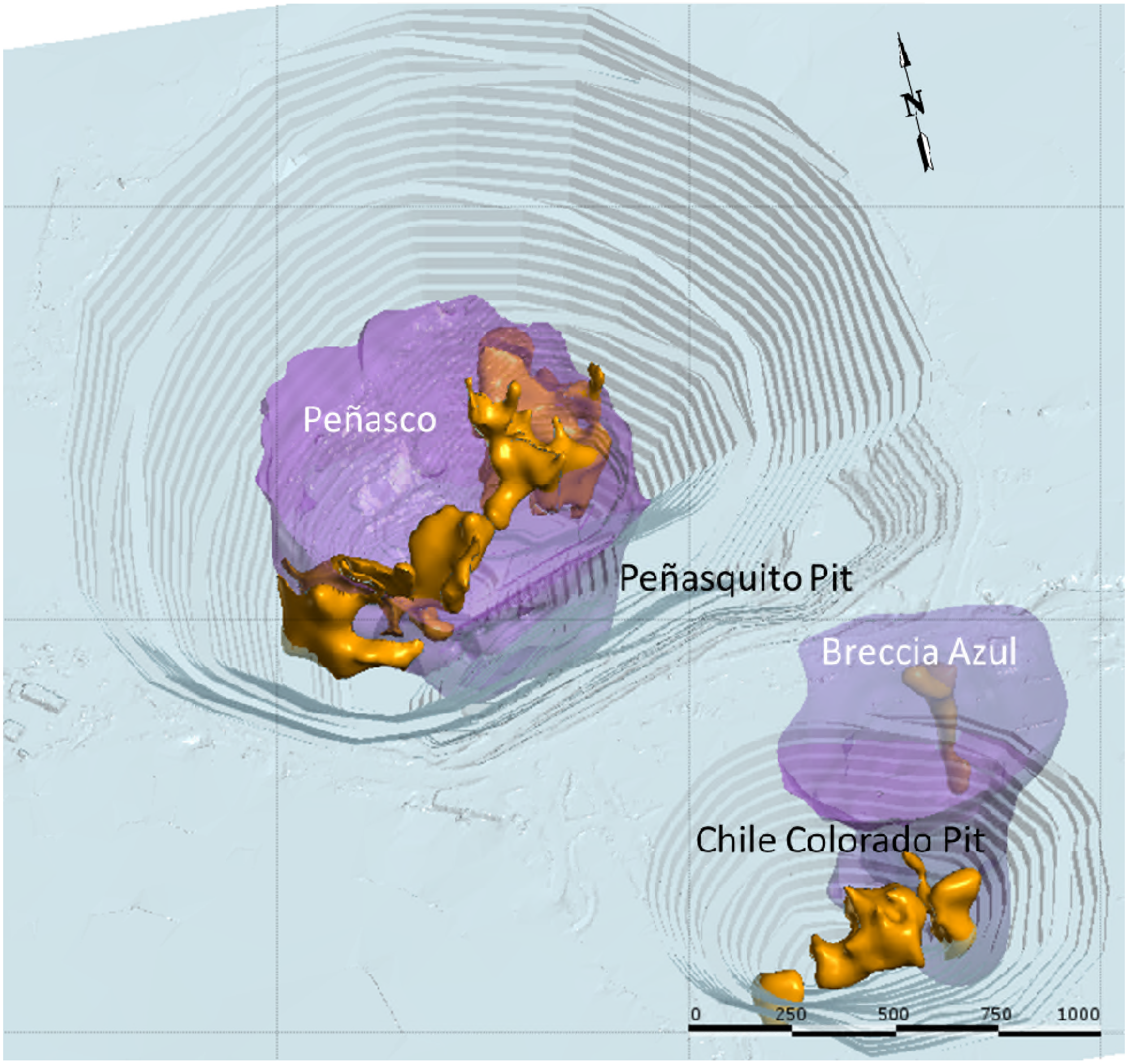
Figure prepared by Goldcorp, 2017.

Figure 14.4: Au Grade Shell Solids, North Oblique View



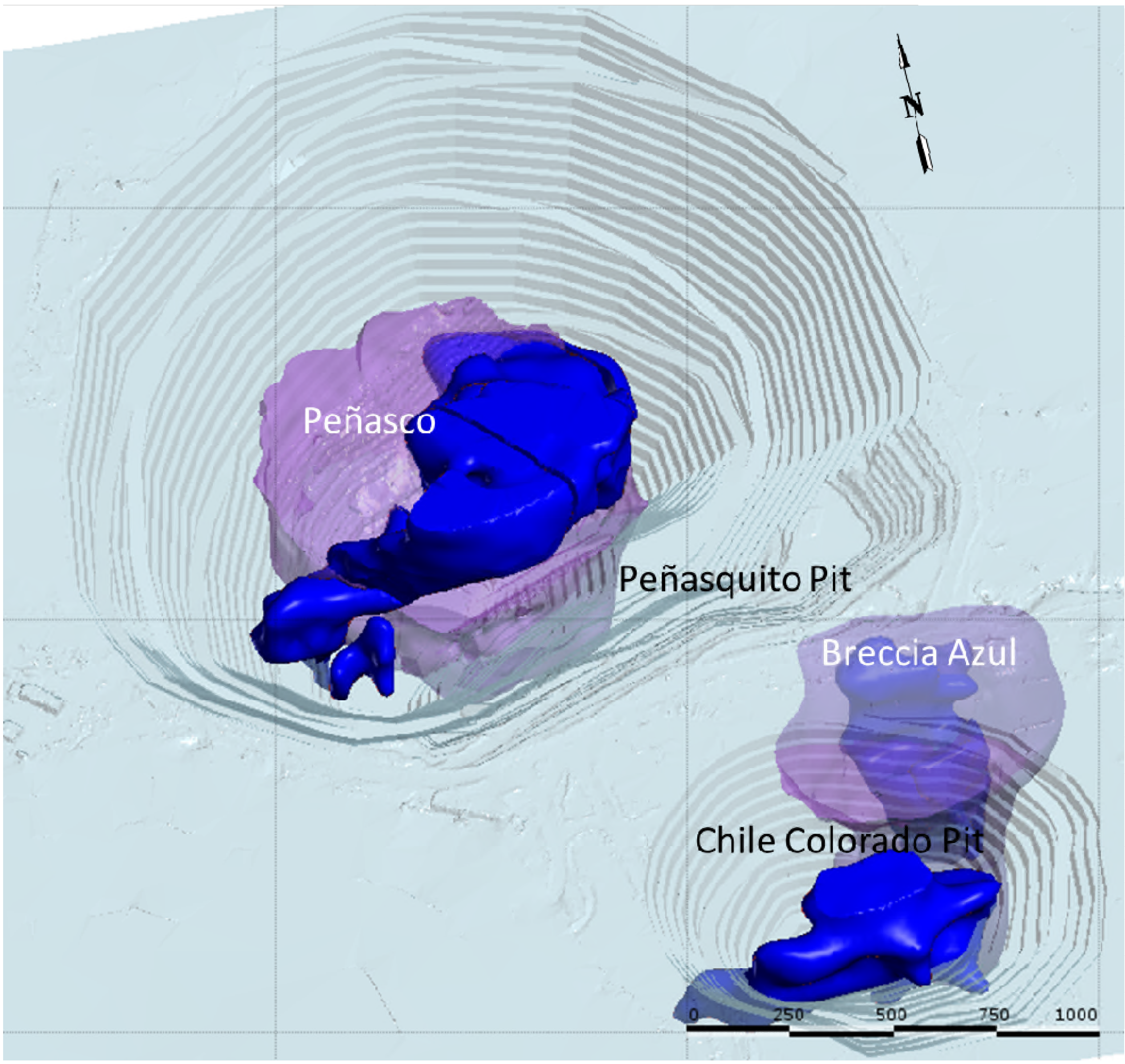
Note: Figure prepared by Goldcorp, 2017, Au High Grade (1.5 g/t) domain solids

Figure 14.5: Ag Grade Shell Solids, North Oblique View



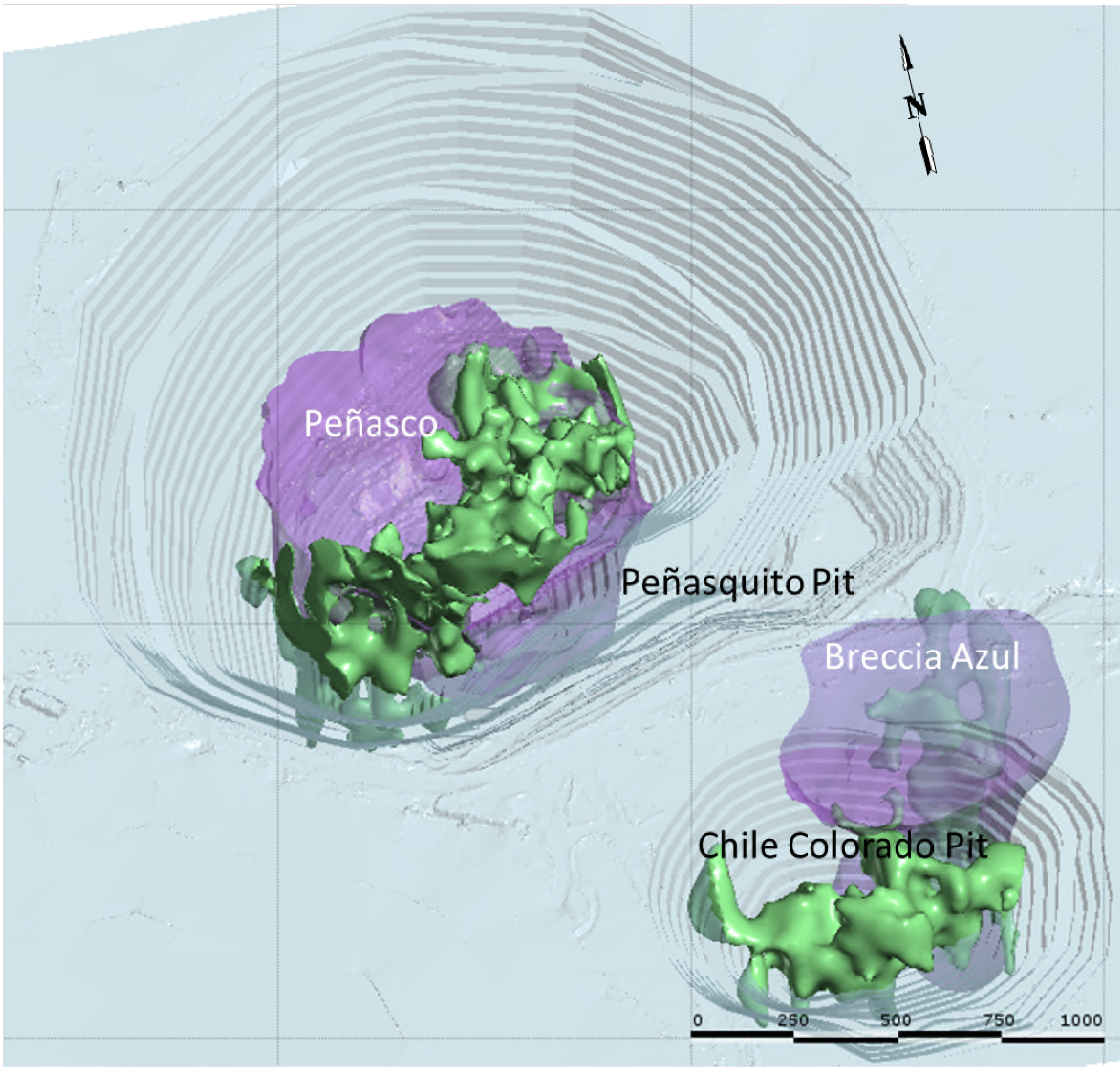
Note: Figure prepared by Goldcorp, 2017, Ag High Grade (50 g/t) domain solids

Figure 14.6: Pb Grade Shell Solids, North Oblique View



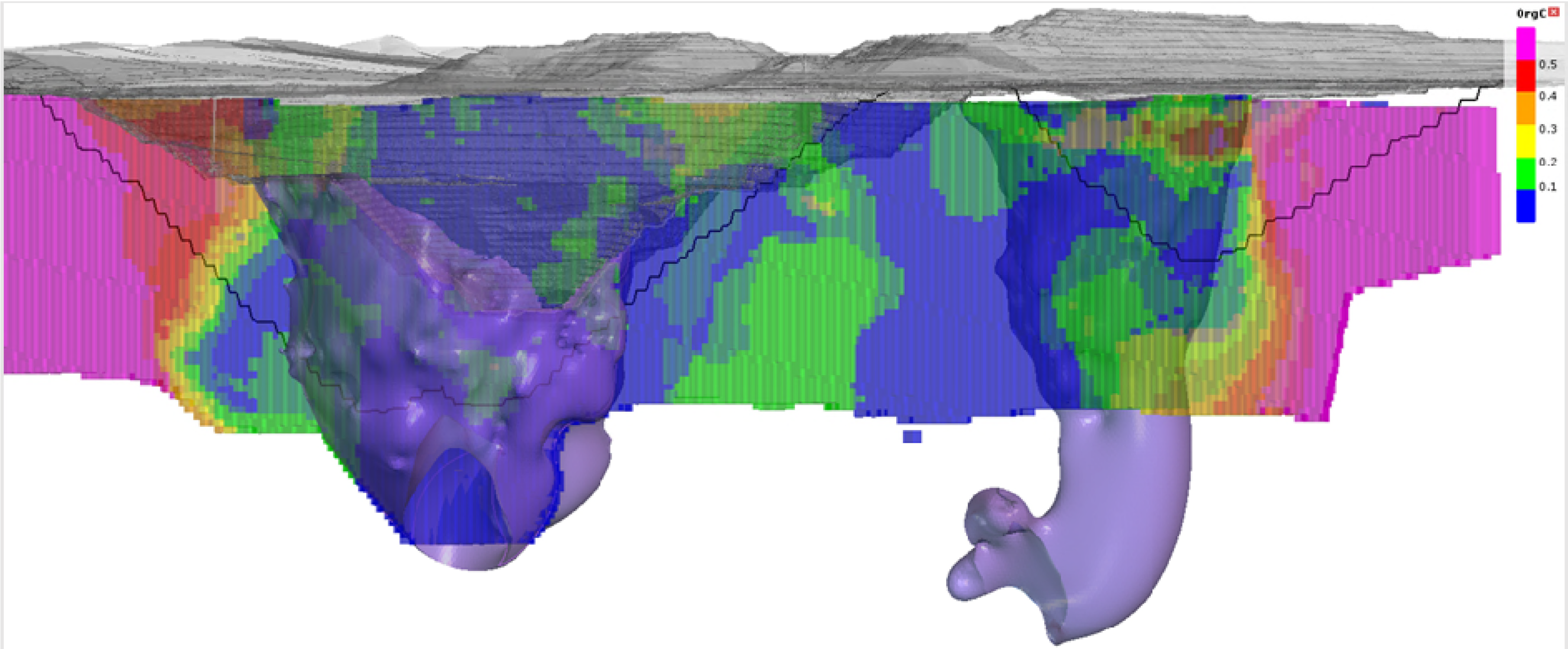
Note: Figure prepared by Goldcorp, 2017, Pb High Grade 5000 ppm) domain solids

Figure 14.7: Zn Grade Shell Solids, North Oblique View



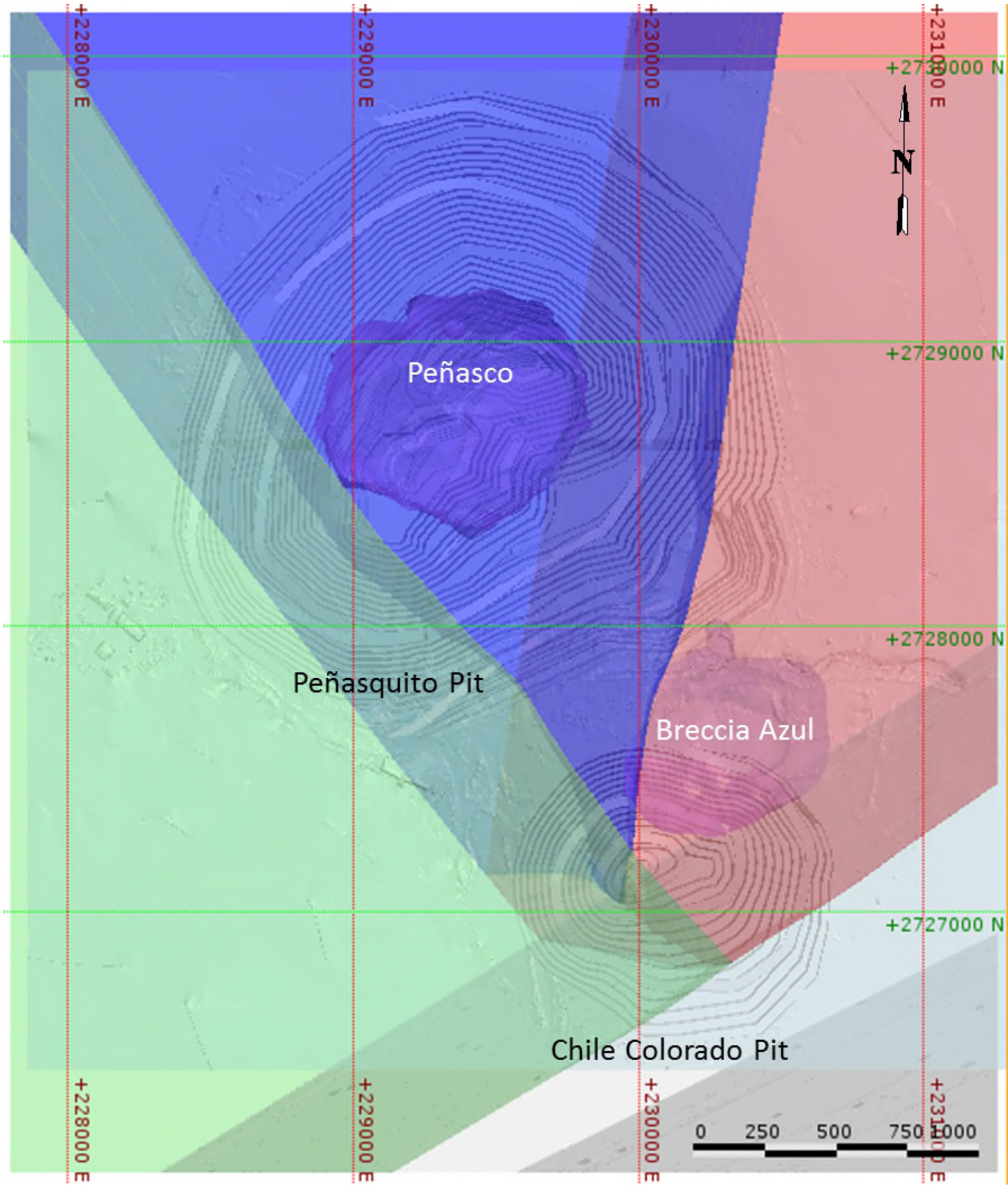
Note: Figure prepared by Goldcorp, 2017, Zn High Grade (1 %) domain solids

Figure 14.8: Organic Carbon Model, Looking East



Note: Figured prepared by Goldcorp, 2017. Horizontal distance across figure is approximately 4 km.

Figure 14.9: Fault Block Domains, Plan View



Note: Figured prepared by Goldcorp, 2017.

14.1.1 Block Model Setup

A block size of 15 m x 15 m x 15 m was used for estimation of Mineral Resources. The model is not rotated.

A total of ten elements were interpolated into the block model (gold, silver, lead, zinc, copper, arsenic, antimony, iron, sulphur and organic carbon), including deleterious and economic elements.

14.1.2 Domaining

Interpolation domains comprise a combination of the alteration, lithology, and where present, grade shell domains. Those combinations were optimized separately for each metal.

For hard contacts, composites within one domain are not used for interpolation outside their corresponding domain. For soft contacts interpolation settings were different for each domain, but composites were used irrespective of domain (shared between domains). Blocks within the Overburden domain were interpolated using hard boundaries with all other domains. All other domains were interpolated using a set of hard–soft boundary matrices that were optimized differently for each element.

14.2 Exploratory Data Analysis

Descriptive statistics were analysed using histograms, cumulative probability plots, box plots, contact plots, and scatter plots.

14.3 Grade Capping

Outlier grades were investigated using cumulative probability plots and histograms of the raw assay grades by estimation domain. Grade caps were applied to raw assay data prior to compositing. The selected cut-off varied by domain and was selected at around the 99th to 99.9th percentile for all interpolated metals (Figure 14-10 and 14-11).

An isotropic search distance of mostly between 30 and 75 m was used to constrain the extrapolation of high grades (outlier restriction) for most domains.

Table 14.1: Grade Au Capping

Au (g/t)		
Domain	**Code**	**Cutoff**
Outside	1000	10
Low	2000	35
Medium	3000	40
High	4000	70

Figure 14.10: Frequency Accumulative Plot. Au Domain 1000

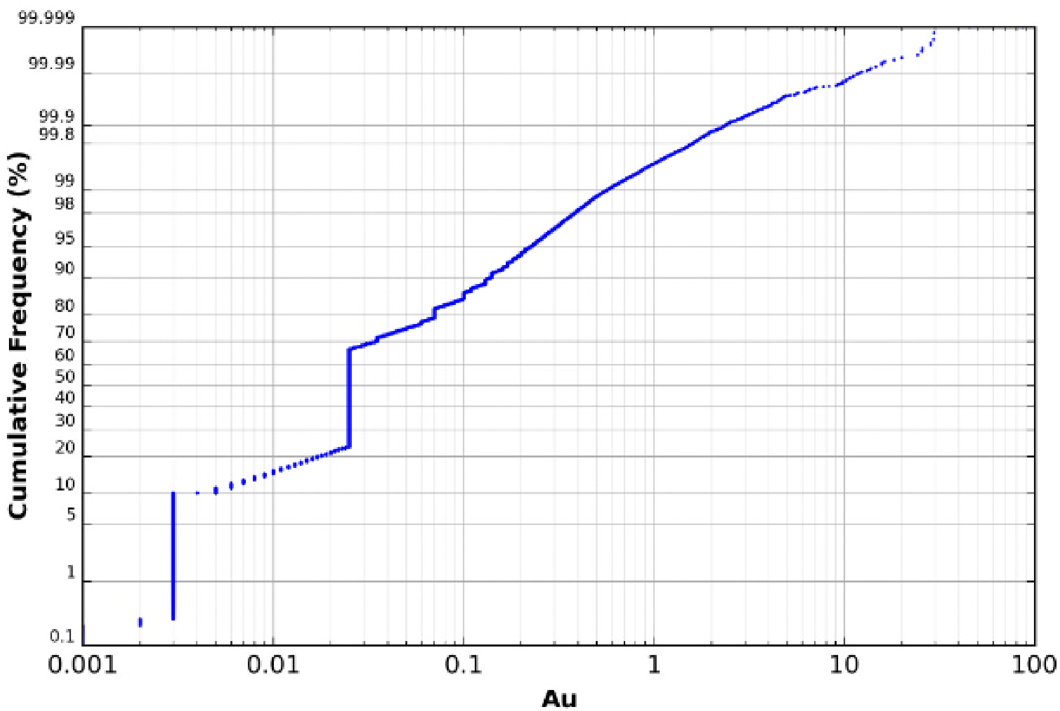
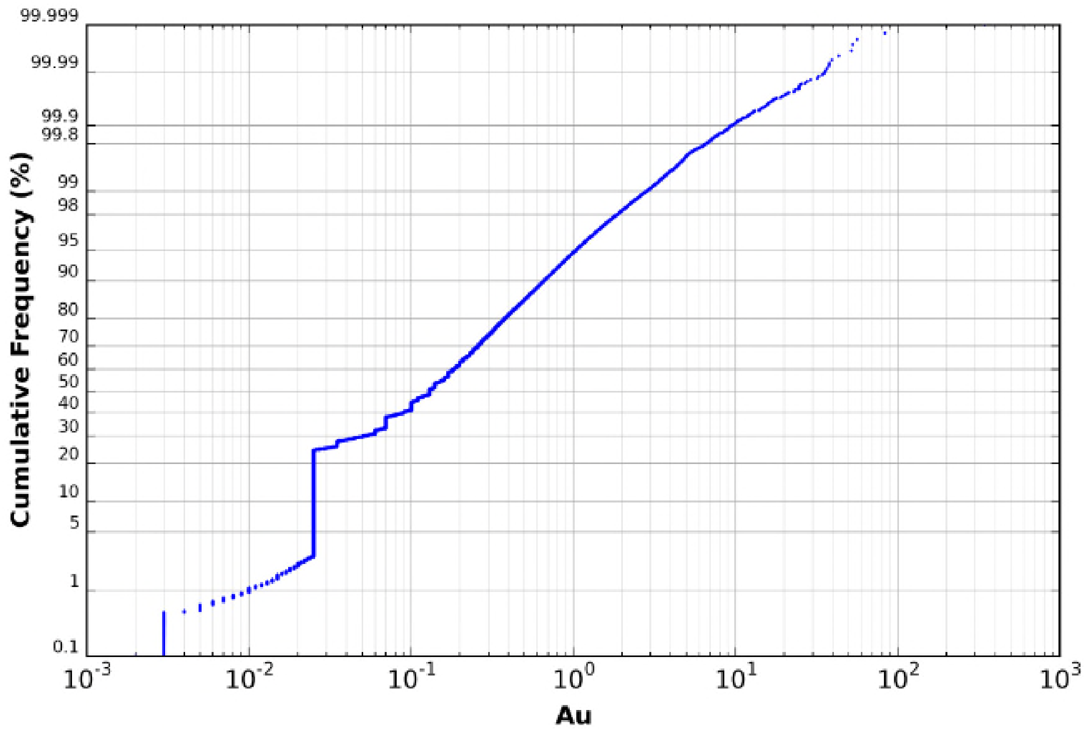


Figure 14.11: Frequency Accumulative Plot. Au Domain 2000



14.4 Composites

Raw assays were composited for all elements prior to estimation to place the assay data on near constant support. Composites were created down each hole at 5 m fixed intervals. In the models that use grade domains, composites were constructed to honour grade–domain contacts, that is, composites end at each grade–domain contact, and start again after it. In the other models, composites start at the top of the first interval with assays and continue to the end of the hole, irrespective of the lithology. Composites <2 m in length were discarded.

14.5 Variography

Multi-directional variograms (correlograms) were developed for gold, silver, lead and zinc for each solid to determine grade continuity of these elements.

- Gold grades typically display 15–30 m ranges with 5–10% nugget effects;
- Silver grades typically display 20–50 m ranges with 10–20% nugget effects;
- Lead grades typically display 30–60 m ranges with 10–20% nugget effects;
- Zinc grades typically display 30–60 m ranges with 10–20% nugget effects.

14.6 Density

Density was tabulated by a combination of lithology, alteration and zone (i.e., Peñasco and Chile Colorado). Density values can be decreased based on the presence of oxides and/or faulting within the block being estimated.

Table 14.2: Density table by zone

ZONE	LITHOLOGY	UNALTERED	QSP	QSPC	PC	SKARN
PEÑASCO	Overburden	2.38				
	Caracol	2.60	2.74	2.72	2.62	2.90
	Other Seds	2.60	2.74	2.83	2.68	2.90
	Bx	2.55	2.64	2.67	2.55	3.08
	QFP	2.55	2.65	2.65	2.55	3.08
	FiFbx/Fti	2.55	2.65	2.65	2.55	3.08
CHILE COLORADO	Overburden	2.38				
	Caracol	2.60	2.74	2.72	2.62	2.90
	Other Seds	2.60	2.74	2.83	2.68	2.90
	Bx	2.45	2.36	2.49	2.45	3.08
	QFP	2.45	2.55	2.55	2.45	3.08
	FiFbx/Fti	2.45	2.55	2.55	2.45	3.08
FAULT ZONES	All	Reduce by 5%				
OXIDES	Weak to Mod	Reduce by 5%				
	Strong	Reduce by 10%				

14.7 Interpolation Methodology

Interpolation was controlled by a combination of the fault block, alteration, lithology, and where present, grade shell domains; different combinations were used for each element. All domains were interpolated using up to three passes.

Interpolation was performed by J. Paz, R. Ruiz, and G. Pareja, with Dr. Pareja supervising the work of the other estimators in his QP role:

- Mr. Paz performed interpolation for arsenic, iron, sulphur and antimony;
- Ms. Ruiz performed interpolation for gold, silver and copper; and
- Dr. Pareja performed the interpolations for lead and zinc.

MineSight mining software was used to performed interpolation.

The metals were interpolated using up to three passes. Passes 1 and 2 were interpolated using ordinary kriging (OK), whereas pass 3 was interpolated using either OK or simple kriging (SK). The minimum number of samples varied, by domain, from two to seven, and the maximum number of samples ranged from four to 30.

14.8 Validation

Model validation includes visual inspection of cross sections (as shown in Figures 14-2 to 14-15), comparing the block model (separately for each metal) against composites and nearest-neighbour (NN) model, and comparing grade–tonnage curves (globally and on a bench by bench basis) of the new model against the ore control model, and against the previous resource model (Figure 14-16). Validation results indicate that the grades in the June 2017 resource model update (for all elements):

- Honour the grades in the drill holes and are free of significant spatial artefacts;
- Are free of significant biases;
- Reproduce the spatial trends in the data without over smoothing of grades.

Figure 14.12: Cross-section showing Au block model and composites

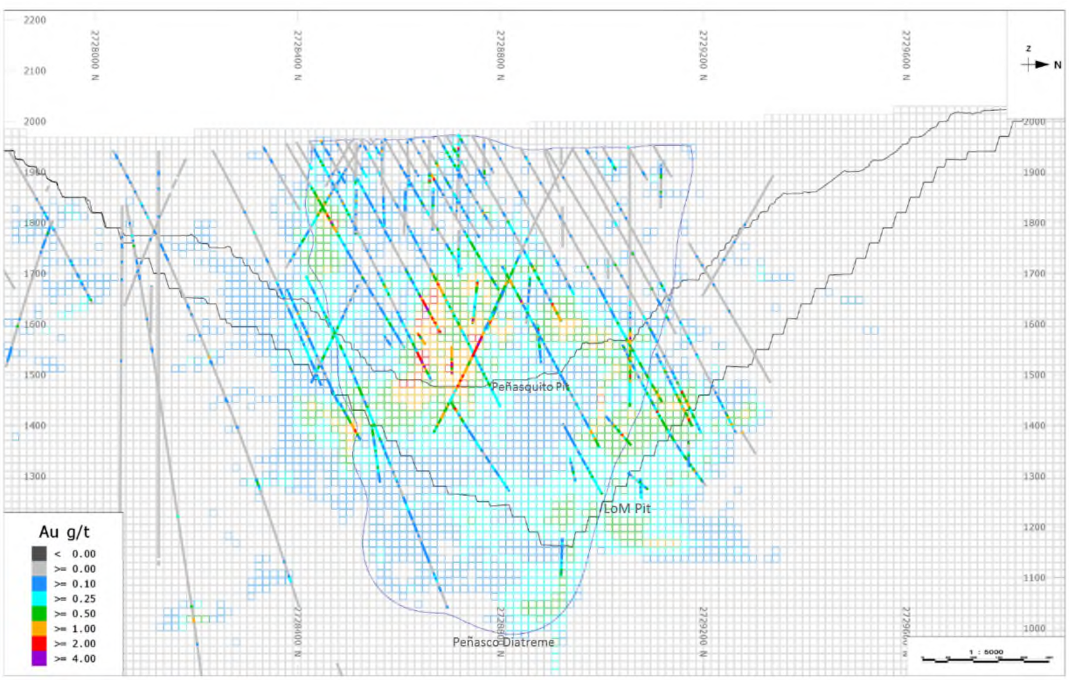


Figure 14.13: Cross-section showing Ag block model and composites

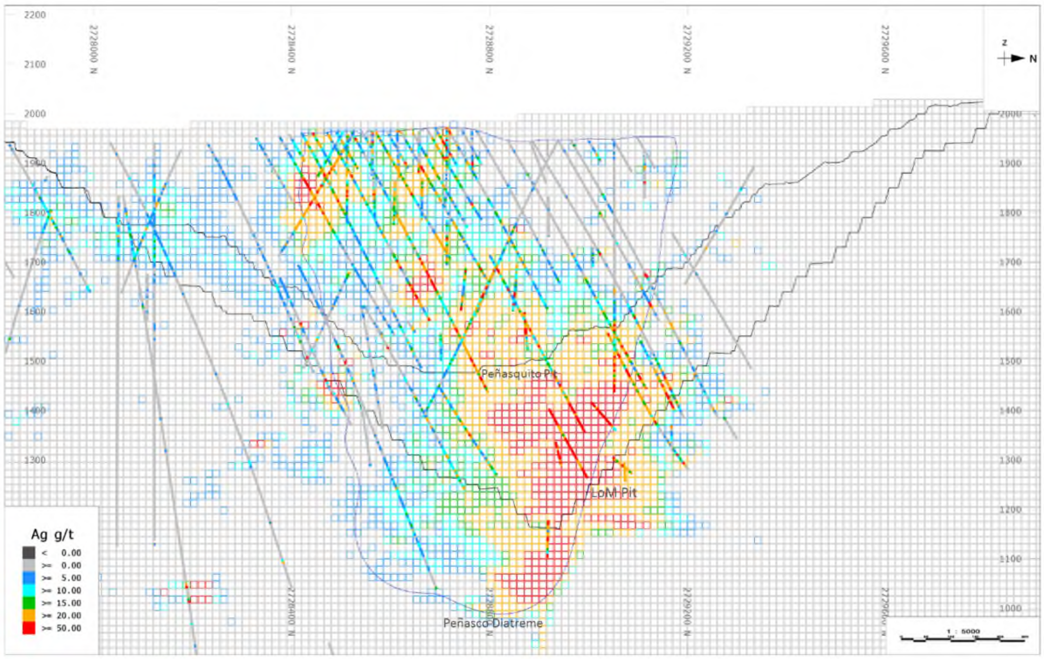


Figure 14.14: Cross-section showing Pb block model and composites

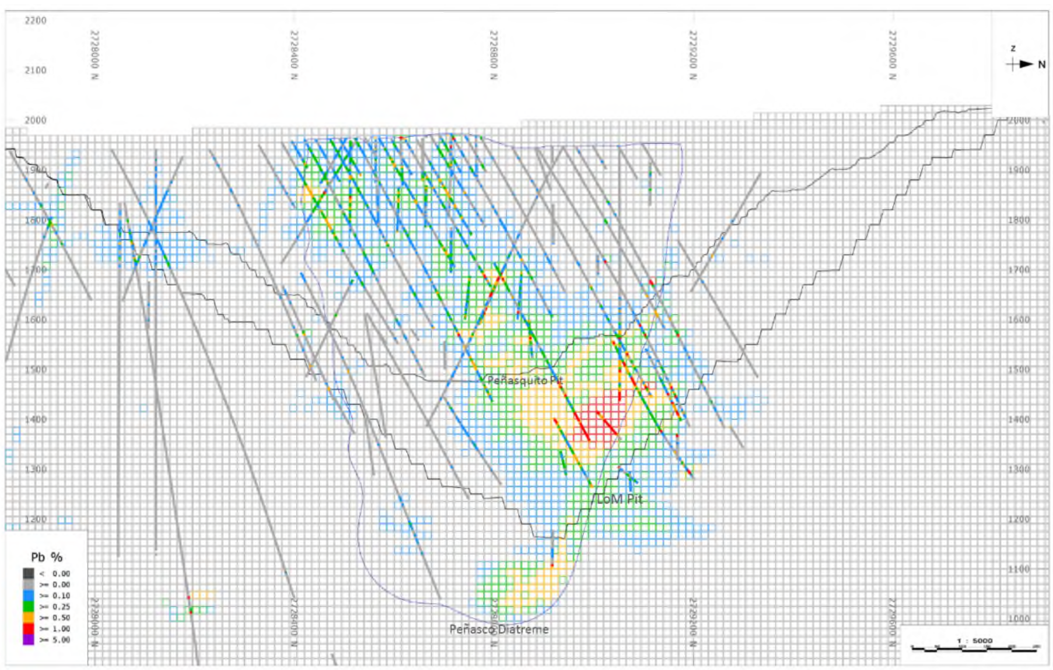


Figure 14.15: Cross-section showing Zn block model and composites

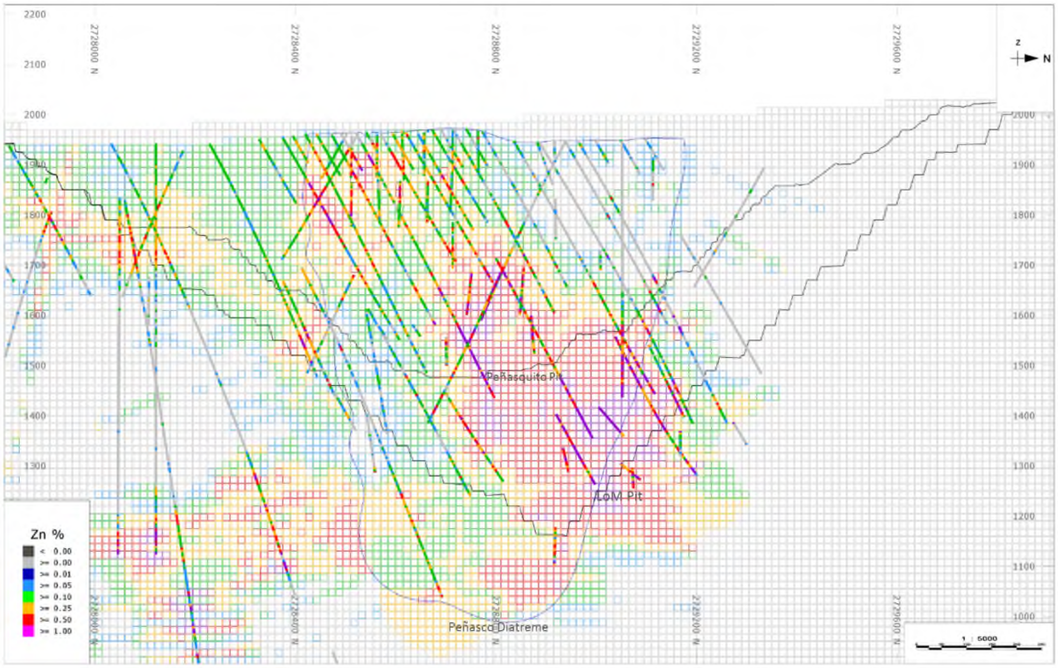
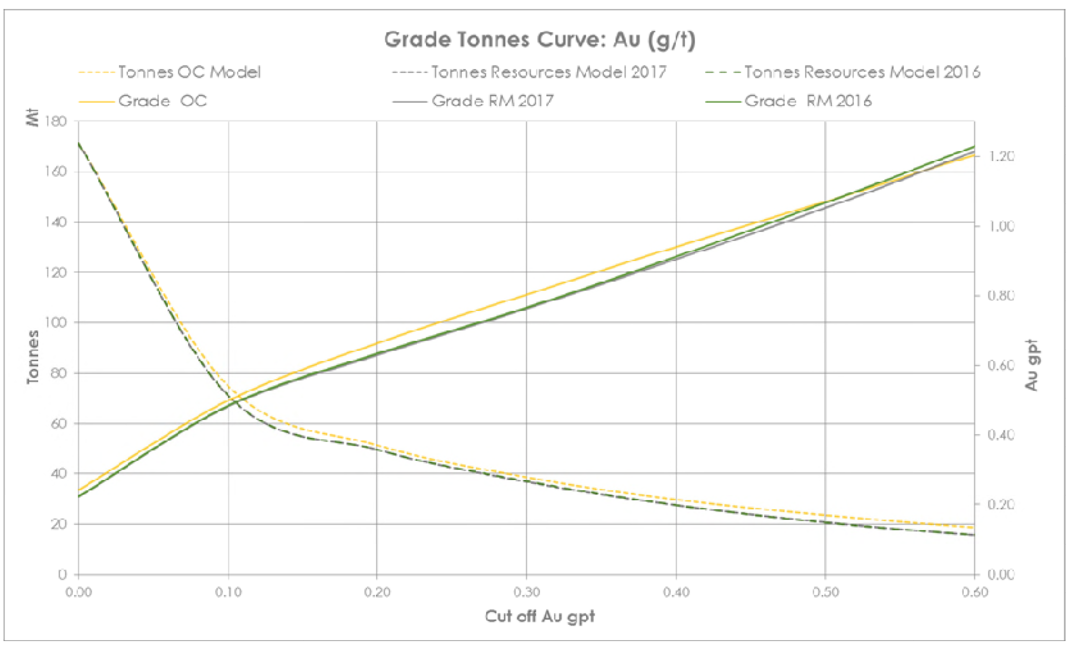


Figure 14.16: Grade-Tonnes Curve Au



14.8.1 Reconciliation

Reconciliation results from July 2017 to June 2018 comparing the Mineral Reserves to the short-range model and mill feed supports the Mineral Resource model (particularly gold). The reconciliation factors are:

RF1: Short range model /Long range model

RF2: Mill Feed / Short range model

RF3: Mill Feed / Long range model

The RF1, RF2, and RF3 factors are based on:

- Short range model: Estimates in situ using the topographies of end month using Ore Control polygons including interactions stockpiles.
- Long range model: Estimates in situ using the topographies of end month using Technical Economic Model including interactions stockpiles.
- Mill Feed: Official process plant monthly report.
- The reconciliation factors are updated every month and an annual compilation for calculation of dilution factor is conducted.

Reconciliation factor ratios for tonnes, Au, Ag, Pb, Zn, and AuEq are listed in Table 14.3. As an average for a one-year period, results from RF3 show approximately 3% less tonnes and 2% higher AuEq grade being processed as expected from the Mineral Reverse model.

Table 14.3: Reconciliation factors period July 2017 to June 2018

	RF1	RF2	RF3
Tonnes	0.94	1.03	0.97
Au grade	1.12	0.89	0.99
Ag grade	1.21	0.85	1.02
Pb grade	1.05	0.93	0.97
Zn grade	1.12	0.97	1.08
AuEq grade	1.14	0.90	1.02

14.9 Mineral Resource Classification

The classification criteria used are as follows:

- Measured Mineral Resources (code 1): blocks were classified as Measured if there were at least three drill holes within 55 m from the block centroid;
- Indicated Resources (code 2): blocks were classified as Indicated if there were at least two drill holes within 110 m from the block centroid;
- Inferred Resources (code 3): blocks were classified as Inferred if there was at least one drill hole within 200 m from the block centroid;
- All blocks within the Overburden domain were classified as Inferred, as long as there was at least one drill hole within 200 m from the block centroid; that is, there are no Measured or Indicated resources in any of those two domains.

Blocks not classified as either Measured, Indicated, or Inferred were coded as “Unclassified” (code 4).

The classification obtained by the previously explained criteria was subsequently modified to eliminate isolated blocks of one class surrounded by blocks of a different class (the “spotted dog effect”). This was accomplished through a python script.

14.10 Assessment of Reasonable Prospects of Eventual Economic Extraction

Mineral Resources that could be extracted using open pit mining methods were assessed for reasonable prospects of eventual economic extraction by confining the mineralization within a large un-engineered pit shell constrained by parameters summarized in Table 14-4. Additional parameters such as capital costs related to mining fleet replacement or expansion, further tailing facility or waste dump expansions have not been considered in this larger pit shell.

14.11 Mineral Resource Statement

Mineral Resources are reported using a gold price of US$1,400.00/oz, a silver price of US$20.00/oz, a lead price of US$1.00/lb and a zinc price of US$1.10/lb.

Cut-off determination methodology is similar to Mineral Reserves, except for the metal prices used. The cut-off is based on generating positive net smelter return on a block-by-block basis applying all revenue and associated costs. The incremental cost used for mill feed material is US$11.90/t, and for leach material is US$4.90/t, and includes all process operating, administrative and sustaining capital costs. Other factors considered are product freight to market costs, smelter costs (including penalties) and royalties.

Table 14.4: Lerchs-Grossman Optimization Parameters

Deposit	Parameter	Amount and Units
Peñasco + Chili Colorado	Base Waste Mining Cost (at pit crest)	2.00 $/t mined
	Base processed material Mining Cost	2.00 $/t mined
	Mining Cost Reference Bench (el.)	1985 m
	Mining Incremental Cost with Pit Depth below Ref. Bench	0.015 $/t mined per 15 m
	Average Life of Mine Mining Cost	*2.20 $/t mined*
	Mill Base Processing Cost (before Pyrite leach)	5.71 $/t milled
	Incremental Pyrite Leach Processing costs	1.66 $/t milled
	Incremental Heap Leach Processing Costs	4.90 $/t leached
	Tailing Management Expansion Costs	1.62 $/t milled
	General Sustaining Capital Costs	0.66 $/t milled
	Administration Costs	0.92 $/t milled
	Total Incremental Operating Costs used for Milling Cut-off (before Pyrite leach)	*8.00 $/t Milled*
	Total Incremental Operating Costs used for Milling Cut-off (with Pyrite Leach)	*11.90 $/t Milled*
Metal Prices and Exchange Rate		
Mineral Resources	Gold (Au)	1,400.00 $/oz
	Silver (Ag)	20.00 $/oz
	Lead (Pb)	1.00 $/lb
	Zinc (Zn)	1.10 $/lb
	Mexican Peso/US Dollar	16.25

Mineral Resources have an effective date of 30 June 2017. Mineral Resources are classified in accordance with the 2014 CIM Definition Standards for Mineral Resources and Mineral Reserves. Mineral Resources are reported exclusive of the Mineral Resources that have been modified to produce Mineral Reserves. Goldcorp cautions that Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

The Mineral Resources for the Project are summarized by deposit in Table 14-5. The Qualified Person for the estimate is Dr Guillermo Pareja, a Goldcorp employee.

Table 14.5: Mineral Resource Estimate

Process Route	Category	Tonnes (Mt)	Grade				Contained Metal			
			Gold (g/t)	Silver (g/t)	Lead (%)	Zinc (%)	Gold (Moz)	Silver (Moz)	Lead (Mlb)	Zinc (Mlb)
Mill	Measured	117.47	0.29	29.1	0.26	0.57	1.10	109.97	677.80	1,469.52
	Indicated	132.93	0.25	25.0	0.20	0.47	1.09	106.85	592.71	1,388.60
	Measured + Indicated	*250.40*	*0.27*	*26.9*	*0.23*	*0.52*	*2.18*	*216.82*	*1,270.51*	*2,858.13*
	Inferred	23.53	0.29	18.8	0.16	0.59	0.22	14.21	85.21	306.74
Heap Leach	Measured	8.59	0.21	29.1	-	-	0.06	8.05	-	-
	Indicated	16.33	0.21	24.1	-	-	0.11	12.66	-	-
	Measured + Indicated	*24.92*	*0.21*	*25.9*	-	-	*0.17*	*20.71*	-	-
	Inferred	0.14	0.21	8.9	-	-	0.0	0.04	-	-

Notes to accompany Mineral Resource Table:

1. Dr. Guillermo Pareja, P.Geo.,a Goldcorp employee is the Qualified Person for the estimate. The estimate has an effective date of 30 June 2017.
2. Mineral Resources are classified as Measured, Indicated and Inferred Mineral Resources, and are based on the 2014 CIM Definition Standards.
3. Mineral Resources are exclusive of Mineral Reserves.
4. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability.
5. Based on US$ commodity prices of $1,400 per ounce gold, $20.00 per ounce silver, $1.00 per pound lead and $1.10 per pound of zinc.
6. Mineral Resources were assessed for reasonable prospects of eventual economic extraction by confining the mineralization within an optimized pit shell.
7. The resource block model includes internal and contact dilution. The estimated metallurgical recovery rate for the Peñasquito Mill is assumed similar for both Mineral Resources and Mineral Reserves.
8. Mineral Resource cut-off determination methodology is similar to Mineral Reserves, except metal pricing as noted.
9. Tonnages are rounded to the nearest 10,000 tonnes; grades are rounded to two decimal places except for silver which is one decimal place.
10. Rounding as required by reporting guidelines may result in apparent summation differences between tonnes, grade and contained metal content.
11. Tonnage and grade measurements are in metric units. Contained gold and silver ounces are reported as troy ounces. Contained lead and zinc pounds are Imperial pound units.

14.12 Factors That May Affect the Mineral Resource Estimate

Risk factors that can affect the Mineral Resource estimates are: metal prices and exchange rate may be different from what was assumed; assumptions which are used in the shell constraining Mineral Resources, including mining, processing and general and administrative (G&A) costs may be different; metal recoveries; geotechnical and hydrogeological assumptions; and assumptions that the operation will maintain the social licence to operate may be different.

Other risks associated with the Mineral Resource estimate are:

- Grade continuity is still not very well understood on a local scale
- In several of the interpolated elements (in particular, Cu, Sb, and Pb) there are significant differences (bias) between the drillhole and the (ore control) blasthole assays.
- Drillhole organic carbon assay data at Peñasquito is more scarce than for the other assayed elements (e.g., Au, Ag, etc.).
- There are a few combinations of lithology ± alteration that are currently under sampled for density.

14.13 Comments on the Mineral Resource Estimate

In the QP's opinion, the Mineral Resources have been classified in accordance with the 2014 CIM Definition Standards for Mineral Resources and Mineral Reserves.

To the extent known to the QP, there are no known environmental, permitting, legal, title-related, taxation, socio-political or marketing issues that could materially affect the Mineral Resource estimate that are not documented in this Report.

15.0 MINERAL RESERVE ESTIMATES

15.1 Conversion Factors from Mineral Resources to Mineral Reserves

For a large open pit mining operation such as the Peñasquito Operations, the conversion of Mineral Resources to Mineral Reserves includes the consideration of many factors, such as those listed below. As the Project has now been in commercial production since 2010, Goldcorp's understanding of most of these technical factors is advanced and supported by significant operational experience:

The key factors that are used in conversion of Mineral Resources to Mineral Reserves include:

- Long term metal price and local currency exchange assumptions;
- Metal recoveries to final product or into concentrates;
- Long term net smelter terms and marketing assumptions;
- Operating cost estimation including mining, processing, general and administrative and other cost assumptions;
- Internal and contact dilution and mining losses;
- Geotechnical and hydrogeological conditions within the pit area;
- Mill throughput and heap leach stacking limits;
- Mining equipment productivity rates;
- Practical pit design features such as: haulage ramps, safety berms, bench heights fixed to the mining equipment, and minimum phase mining widths;
- Growth and sustaining capital requirements;
- Available land for waste rock disposal and low-grade stockpile storage;
- Tailing capacity and heap leach pad space requirements;
- Infrastructure requirements such as power and dewatering; and
- Environmental, permitting, legal, title, taxation, socio-economic, political setting.

To define the open pit Mineral Reserves for the Peñasquito Operations, Goldcorp undergoes a four-step process as follows:

- Step 1:
  - The Peñasquito contained-metal resource block model described in Section 14 is further interpolated with a series of software scripts in which an NSR value is calculated for each block. A block's NSR value is based on assumed marketing terms, payable metal prices, plant recovery of metals to a series of concentrate products; and additional out-of-gate costs such as treatment charges and concentrate shipping fees are estimated for each block and stored as an attribute within the block model project. To represent sensitivity to all of the above parameters and the payable differences between pyrite leach processing and the current mill configuration, several different NSR values were estimated for each block in the block model;
- Step 2:
  - The Peñasquito NSR block models then undergoes a process of "pit optimization" where Whittle mine planning software optimizes the potential future financial return for a number of intermediate or interim pit shells and defines the ultimate pit size and shape for the Peñasco and Chile Colorado pits. To complete this optimization, geotechnical limitations that define the maximum slope angles that can be achieved in each pit, and economic parameters including a range of metal prices, applicable royalty/revenue-based taxes, mine, mill, and administrative operating costs, and metallurgical recoveries are included for the Measured and Indicated Resource blocks of the models. The software then interrogates each block of the block model as to its ability to pay for its removal and required processing/administrative costs and net revenue, taking into account the incremental tonnage and associated costs of waste that must be removed to mine the block. The pit shell offering the best economic results then defines in a general way the size and shape of the ultimate pit that achieves the maximum financial return based on the defined parameters while maintaining the geotechnical limitations;
- Step 3:
  - With the ultimate pit limits defined, practical design parameters such as haulage ramps, safety berms and practical interim cutback limits based on the overall size of the pit, and the equipment to be used are completed within a mine design software package. This process results in a series of minable cutbacks that together form the ultimate pit design for the deposit;
- Step 4:
  - With each cut-back designed, a series of potential production schedules are produced based on the practical sequencing of each cut-back, the mining equipment available or available with additional capital expenditures, the practical limitations of the amount of mining equipment that can be operated on each cut-back, the production rates of equipment in different material types (overburden and bedrock), the haulage distance

to waste dumps, ore stockpiles or to the mill crusher and the limitations of the throughput capacity of the mill or heap leach pad itself.

From this process, which in most cases is iterative, a practical LOM production schedule is developed that seeks to maximize the metal production and minimize operating and capital costs and defines the annual mining, milling and metal production schedules.

As part of day-to-day operations, Goldcorp will continue to undertake reviews of the production schedule and consideration of alternatives to, and variations within, the presented mine plan. Alternative scenarios and reviews can be based on ongoing or future mining considerations, evaluation of different potential input factors, assumptions and corporate directives.

The current mine plan is based on the 2017 Mineral Reserve estimates and will produce oxide and sulphide material to be processed through the existing heap leach facility and sulphide plant respectively over a 12-year mine life (2018–2029).

Table 15-1 shows the key operating cost, metal price factors and currency exchange rates used to define the pit optimization process described above for Mineral Reserve estimation. Other technical mining factors that influence the Mineral Reserve are described in Section 16 of this Report.

15.2 Mineral Reserve Statement

Mineral Reserves are classified in accordance with the 2014 CIM Definition Standards for Mineral Resources and Mineral Reserves.

The Qualified Person for the estimate is Mr. Victor Vdovin, P.Eng., a Goldcorp employee.

Mineral Reserves for the total operations are summarized in Table 15-2 and have an effective date of 30 June 2017.

15.3 Factors That May Affect the Mineral Reserve Estimate

Risk factors that can affect the Peñasquito Mineral Reserve estimates include: the reliability of the resource block model; metal prices and exchange rate assumptions; operating and capital cost assumptions; geotechnical slope stability; sufficient tailing and waste dump storage capacity; marketing and net smelter term assumptions; availability of water sufficient to support the process plant throughput rate assumptions; deleterious substances in mineralization that may affect metallurgical recovery rates, social licence to operate being maintained; and any additional modifications to the proposed changes to the taxation and royalty regime.

Figure 15.1: NSR Calculation Script´s Flow Chart

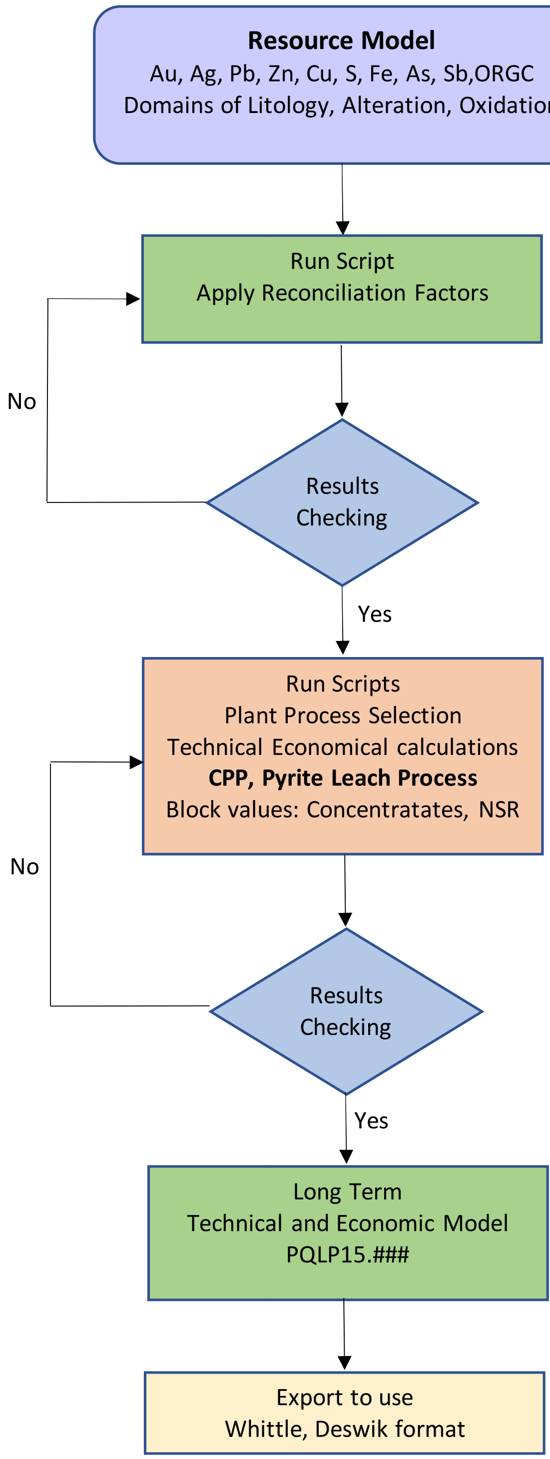


Table 15.1: Lerchs-Grossman Optimization Parameters

Deposit	Parameter	Amount and Units
Peñasco + Chili Colorado	Base Waste Mining Cost (at pit crest)	2.00 $/t mined
	Base ore Mining Cost	2.00 $/t mined
	Mining Cost Reference Bench (el.)	1985 m
	Mining Incremental Cost with Pit Depth below Ref. Bench	0.015 $/t mined per 1 5m
	Average Life of Mine Mining Cost	*2.20 $/t mined*
	Mill Base Processing Cost (before Pyrite leach)	5.71 $/t milled
	Incremental Pyrite Leach Processing costs	1.66 $/t milled
	Incremental Heap Leach Processing Costs	4.90 $/t leached
	Tailing Management Expansion Costs	1.62 $/t milled
	General Sustaining Capital Costs	0.66 $/t milled
	Administration Costs	0.92 $/t milled
	Total Incremental Operating Costs used for Milling Cut-off (before Pyrite leach)	*8.00 $/t Milled*
	Total Incremental Operating Costs used for Milling Cut-off (with Pyrite Leach)	*11.90 $/t Milled*
Metal Prices and Exchange Rate		
Mineral Reserves	Gold (Au)	1,200.00 $/oz
	Silver (Ag)	18.00 $/oz
	Lead (Pb)	0.90 $/lb
	Zinc (Zn)	1.05 $/lb
	Mexican Peso/US Dollar	16.25

Table 15.2: Mineral Reserve Estimate

Process Route	Category	Tonnes (Mt)	Grade				Contained Metal			
			Gold (g/t)	Silver (g/t)	Lead (%)	Zinc (%)	Gold (Moz)	Silver (Moz)	Lead (Mlb)	Zinc (Mlb)
Mill	Proven	352.66	0.59	35.4	0.35	0.75	6.70	400.97	2,697.06	5,868.13
	Probable	162.37	0.41	26.4	0.24	0.51	2.13	137.86	826.95	1,842.24
	Proven + Probable	***515.03***	***0.53***	***32.5***	***0.31***	***0.68***	***8.83***	***538.83***	***3,560.00***	***7,710.38***
Heap Leach	Proven	8.52	0.38	22.6	-	-	0.10	6.19	-	-
	Probable	1.20	0.24	13.9	-	-	0.01	0.54	-	-
	Proven + Probable	***9.72***	***0.36***	***21.5***	-	-	***0.11***	***6.73***	-	-

Notes to accompany Mineral Reserves Table:

1. Mr. Victor Vdovin, P.Eng., a Goldcorp employee, is the Qualified Person for the estimate. The estimate has an effective date of 30 June 2017.
2. The Mineral Reserves are classified as Proven and Probable Mineral Reserves and are based on the 2014 CIM Definition Standards.
3. Based on a gold price of $1,200 per ounce, a silver price of $18.00 per ounce, a lead price of $0.90 per pound and a zinc price of $1.05 per pound; and an economic function that includes variable operating costs and metallurgical recoveries.
4. Prior to the pyrite leach circuit, the estimated recovery rate for the Peñasquito Mine ("Mill") averages 60.5% for gold, 78.9% for silver, 75.2% for lead and 79.3% for zinc. After the pyrite leach circuit, the estimated recovery rate for the Peñasquito Mine ("Mill") averages 72.3% for gold and 87.2% for silver, with other metal recoveries unchanged. A pyrite leach gold recovery circuit is assumed to be operational late 2018. Recovery relationships of the ore types are very complex and can vary considerably from these averages.
5. The estimated metallurgical recovery rate for the Peñasquito Mine ("Heap Leach") is 59.0% for gold and 25.5% for silver.
6. The Mineral Reserve cut-off is based on generating positive net smelter return on a block-by-block basis applying all revenue and associated costs. The incremental cost used for milled ore is US$ 11.90 per tonne, and for leach ore is US$4.90 per tonne, and includes all mill operating, administrative and sustaining capital costs. Other factors considered are product freight to market costs, smelter costs (including penalties) and royalties.
7. A forward sales contract for 25% of silver production exists with Wheaton PM.
8. Tonnages are rounded to the nearest 10,000 tonnes; grades are rounded to two decimal places except for silver which is one decimal place.
9. Rounding as required by reporting guidelines may result in apparent differences between tonnes, grade and contained metal content.
10. Tonnage and grade measurements are in metric units. Contained gold and silver ounces are reported as troy ounces. Contained lead and zinc pounds are Imperial pound units.

15.4 Mining Dilution and Losses

Dilution is accounted for in the block model by ensuring the models have the appropriate change of support to produce a grade–tonnage curve that reflects the expected mining selectivity. Block models also incorporate anticipated contact dilution through the interpolation plan that utilizes both mineralization and waste samples at the ore/waste boundary within a given interpolation domain. Thus, no further dilution or mining loss factors are needed to reflect the appropriate grade and tonnage distributions, and this has been supported by a reconciliation analysis of past production.

However, Goldcorp conducts dilution studies on as needed basis and dilution correction factors based on mine to mill reconciliation are periodically applied or updated.

Because the same models are used for both Mineral Reserves and Mineral Resources, dilution or mining loss is incorporated in both estimates. Mineral Reserves and Mineral Resources are reported at 100% of the block model.

15.5 Comments on the Mineral Reserve Estimate

In the QP's opinion, the Mineral Reserves for the Peñasquito Operations have been estimated using industry best practices and have been reported in accordance with the 2014 CIM Definition Standards for Mineral Resources and Mineral Reserves.

16.0 MINING METHODS

16.1 Introduction

Only Measured and Indicated Mineral Resources were considered as candidates for ore in the pit optimization process, Mineral Reserve statement and life of mine plan. All blocks classified as Inferred or below the incremental NSR cut-off were assumed to be waste regardless of metal grade values.

16.2 Geotechnical and Hydrological Parameters

Overall pit slope angles vary by sector within both Peñasco and Chile Colorado open pits and are based on the recommendations in a slope stability study performed by Call & Nicholas, Inc. (CNI) in 2010. As mining operations progress in the pit, further geotechnical drilling and stability analysis will continue to be completed by Goldcorp to further optimize the geotechnical parameters in the LOM designs.

The overall designs are based around double benching of 15 m mining bench intervals and take into account haulage ramp positioning, safety berms and other geotechnical features required to maintain safe inter-ramp slope angles.

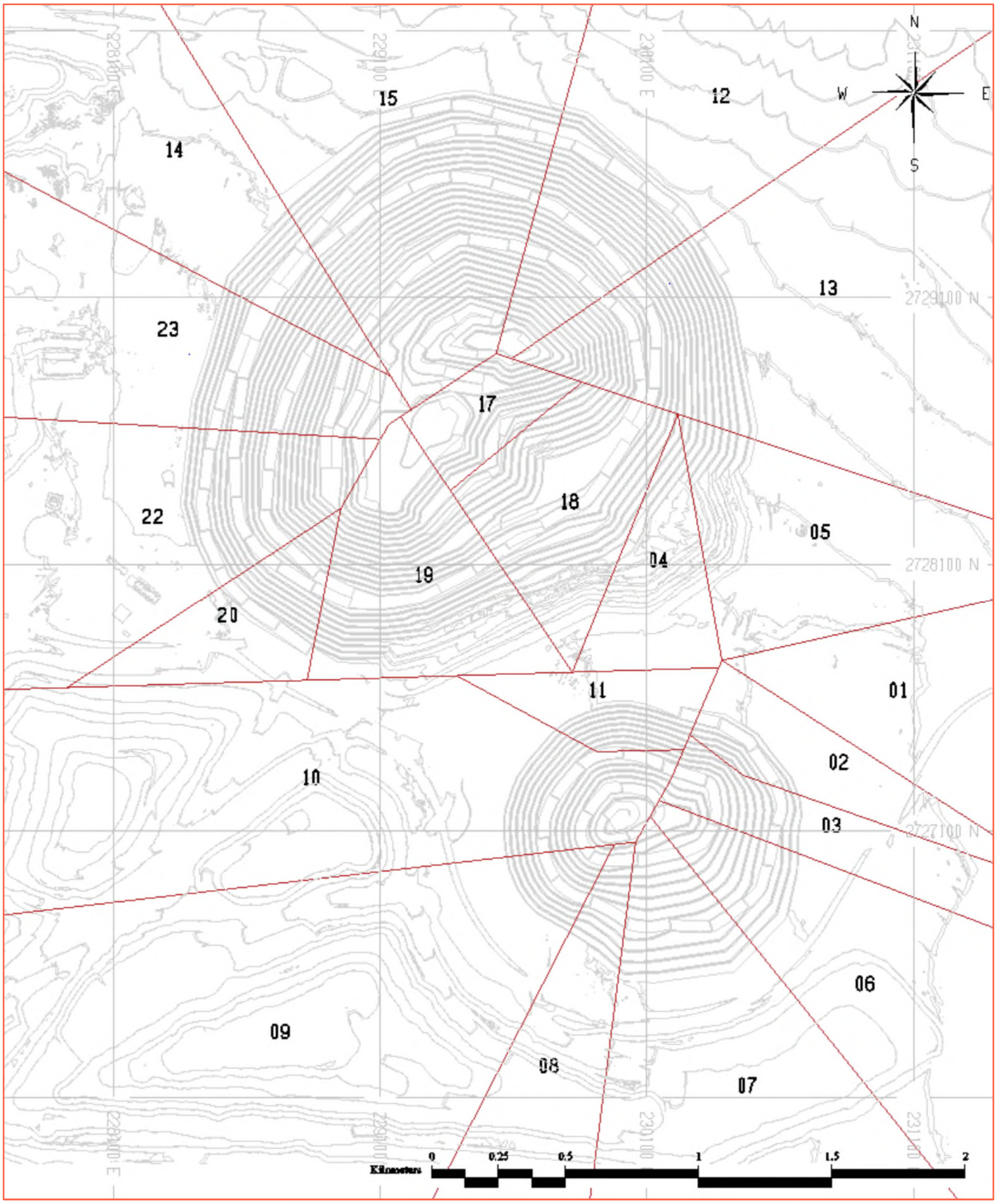
Geotechnical design sectors are illustrated in Figure 16-1. Pit slope angles and bench design parameters for the sectors are as indicated in Table 16-1, Table 16-2, and Table 16-3.

A combination of Goldcorp staff and external consultants have developed the pit water management program, completed surface water studies, and estimated the life- of-mine site water balance. Management of water inflows to date have been appropriate, and no hydrological issues that could impact mining operations have been encountered.

Water levels are maintained at least 30 m below the active mining elevation (bench) to ensure efficient production and safe access. The current pumping system consists of 7 wells surrounding the current Peñasco open pit. 6 wells are located inside the pit and the other one well is located outside the current mining boundary, but within the overall tenement holdings.

The mine dewatering wells are drilled to 17” (43 cm) diameter and then a 10” (25.4 cm) casing is installed with gravel pack between the casing and drill hole to provide a conductive flow path. The average depth of the wells is 850 m. All wells are vertical and contain downhole submersible pumps which discharge into high-density polyethylene (HDPE) conveyance lines for collection in the fresh water pond.

Figure 16.1: Geotechnical Slope Sectors Map with Ultimate Pit Design



Note: Figure prepared by Goldcorp from sectors designed by CNI, 2010.

Table 16.1: Pit Slope Angles by Sector

Section Code	Dbench Slope	# of Roads	LG Slope
1 - CH_E1	54	0	47
2 - CH_E2	53	1	47
3 - CH_E3	50	2	48
4 - Ch_N1	53	2	47
5 - Ch_N2	55	1	47
6 - CH_S1	49	3	45
7 - CH_S2	35	3	32
8 - CH_S3	48	2	44
9 - CH_S4	51	2	43
10 - CH_W1	53	3	49
11 - CH_W2	53	2	47
12 - PEN_E1	51	4	42
13 - PEN_E2	53	3	47
14 - PEN_N1	48	4	44
15- PEN_N2	49	6	43
16	no code	no code	no code
17- PEN_S1L	51	2	45
18- PEN_S1U	45	1	45
19- PEN_S2	52	2	45
20 - PEN_S3	52	3	46
21	no code	no code	no code
22 _ PEN_W1	53	5	45
23 - PEN_W2	52	6	44

Table 16.2: Double Benching Slope Design Parameters, Peñasco

Design Sector	Wall Dip Direction (degrees)	Single Benching (15 m)			Double Benching[3] (30 m)		
		Inter- ramp Slope Angle (degrees)	Mean Catch[1] Bench Width (m)	Mean Bench[1] Face Angle (degrees)	Inter- ramp Slope Angle (degrees)	Mean Catch [1] Bench Width (m)	Mean Bench[1] Face Angle (degrees)
E1	220	44	10.7	72	51	13.6	73
E2	253	47	9.1	72	53	13.1	75
S1-L	317	45	10.1	72	51	14.2	74
S1-U[2]	317	41	11.8	70	45	18.8	72
S2	350	46	9.6	72	52	13.9	75
S3	35	47	9.1	72	52	13.3	74
W1	77	46	9.6	72	53	13.1	75
W2	102	46	9.6	72	52	13.3	74
N1	134	39	12.5	68	48	15.8	72
N2	169	41	11.8	70	49	15.4	73

Notes:

1. Slopes should be designed and excavated to the mean catch-bench widths and bench-face angles listed above. After excavation, back break along the bench crests will reduce the average catch-bench widths to the required 7.6 m for single benching and 10.6 m for double benching;
2. Double-benching recommendations for sector S1-U only apply if the conditions of water depressurization, unloading, and/or slope layback are met;
3. A 1.5-m offset was assumed for double benching based on operational considerations. If the offset during mining is greater than 1.5 m shallower inter-ramp angles will be achieved, and if the offset is less than 1.5 m steeper inter-ramp angles will be achieved. The offset can be completely avoided if the full double height is drilled as a pre-split row.

Table 16.3: Double Benching Slope Design Parameters, Chile Colorado

Design Sector	Wall Dip Direction (degrees)	Single Benching (15 m)			Double Benching[2] (30m)		
		Inter-ramp Slope Angle (degrees)	Mean Catch[1] Bench Width (m)	Mean Bench[1] Face Angle (degrees)	Inter-ramp Slope Angle (degrees)	Mean Catch [1] Bench Width (m)	Mean Bench[1] Face Angle (degrees)
N1[3]	122	46	11.6	79	53	16.8	79
N2[3]	225	49	9.9	78	55	14.6	78
E1	277	49	8.2	72	54	16.0	79
E2[3]	312	47	11.1	79	53	17.3	80
E3	272	43	10.6	70	50	17.1	75
S1	313	38	14.3	72	49	20.2	79
S2	315 to 005	26	19.0	52	35	26.9	62
S3	21	40	11.8	68	48	17.8	73
S4	57	41	12.4	72	51	17.9	78
W1	124	44	10.7	72	53	16.8	79
W2	78	44	10.7	72	53	16.8	79

Notes:

1. Slopes should be designed and excavated to the mean catch-bench widths and bench-face angles listed above. After excavation, back break along the bench crests will reduce the average catch-bench widths to the required 80% reliability of achieving 7.6 m for single benching and 10.6 m for double benching;
2. A 1.5-m offset was assumed for double benching based on operational considerations. If the offset during mining is greater than 1.5 m inadequate catch-bench widths will be achieved, and if the offset is less than 1.5 m wider catch- bench widths will be achieved. The offset can be completely avoided if the full double height is drilled as a pre-split row;
3. Single bench face angles steeper than 72º may be mined in Sectors N1, N2 and E2 because the bedding is steeply dipping toward the pit.

Well control is through fibre optic line directly connected to the plant control room. This provides the ability to turn wells on and off as well as real time well performance monitoring and reporting (i.e. flow rates, pressures, water temperature, etc.). Finally, pit area water levels are monitored through a network of piezometer wells, located both within the pit and surrounding it, for accurate water level measurement and reporting.

16.3 Mining and Milling Production Rates

The current mine plan is based on the 2017 Mineral Reserve estimate and will produce oxide and sulphide material to be processed through the existing heap leach facility and sulphide plant respectively over a 12-year mine life (2018–2029).

The open pit operations will progress at a nominal annual mining rate of approximately 200 Mt/a until 2020, there on the mining rate will continue to decline as the stripping ratios of ore to waste decrease.

For the milling throughput, the LOM plan assumes a nominal rate of 41 Mt/a until the end of 2028 and the third quarter of 2029, and the heap leach pad will be stacked with incremental oxide ore as it is mined. See Table 16-4.

Table 16.4: Peñasquito LoM Metal Production

Peñasquito - LoM Metal Production

Year	Mill Ore Feed (000)	Gold Grade (g/t)	Silver Grade (g/t)	Lead Grade (%)	Zinc Grade (%)	Gold Cont'd (000 oz)	Silver Cont'd (000 oz)	Lead Cont'd (000 oz)	Zinc Cont'd (000 oz)	Gold Rec'd (000 oz)	Silver Rec'd (000 oz)	Lead Rec'd (000 oz)	Zinc Rec'd (000 oz)	Gold Payable (000 oz)	Silver Payable (000 oz)	Lead Payable (000 oz)	Zinc Payable (000 oz)	PLP Gold Production (000 oz)	PLP Silver Production (000 oz)	HL Gold Production (000 oz)	HL Silver Production (000 oz)	Total Gold Production (000 oz)	Total Silver Production (000 oz)
2018	39,401	0.40	26.9	0.28	0.56	507	34,055	244,593	484,533	298	26,938	180,075	380,784	268	23,934	169,999	323,136	3	227	19	571	290	24,732
2019	41,224	0.44	40.6	0.47	0.71	582	53,752	426,075	646,948	351	43,667	328,360	507,476	306	39,366	312,377	430,236	56	3,528	0	0	362	42,894
2020	41,395	0.63	35.5	0.41	0.75	842	47,286	378,523	684,691	544	37,768	291,851	541,789	482	33,774	275,809	460,871	96	3,941	0	0	578	37,716
2021	41,213	0.78	30.7	0.27	0.70	1,040	40,672	245,839	639,797	665	31,433	181,944	511,702	590	27,836	170,725	434,176	128	4,045	0	0	718	31,881
2022	41,210	0.61	29.3	0.25	0.61	812	38,779	226,956	555,145	496	29,643	167,467	439,819	437	26,266	157,009	373,772	105	3,897	15	421	557	30,584
2023	41,213	0.46	32.3	0.30	0.70	613	42,784	272,942	631,985	341	33,009	204,554	502,901	293	29,296	192,978	428,324	78	3,912	12	289	383	33,497
2024	41,389	0.54	36.5	0.25	0.80	724	48,595	230,400	729,021	407	36,786	170,878	593,719	349	32,539	161,111	504,664	90	4,905	0	0	439	37,444
2025	41,148	0.68	32.6	0.38	0.77	905	43,148	347,735	702,934	588	34,318	266,426	562,192	523	30,535	253,687	478,281	98	3,766	0	0	620	34,302
2026	41,275	0.48	43.0	0.37	0.84	637	57,034	333,707	765,435	385	46,668	252,626	613,972	335	42,039	237,100	522,833	91	4,588	0	0	426	46,627
2027	41,213	0.50	36.3	0.39	0.69	669	48,044	354,084	623,555	408	38,727	269,019	489,407	358	34,799	256,173	416,396	84	4,019	0	0	443	38,817
2028	41,323	0.54	32.3	0.27	0.66	722	42,961	243,025	597,858	430	34,377	177,435	471,450	378	30,764	166,860	401,247	100	3,792	0	0	478	34,556
2029	35,733	0.35	20.3	0.17	0.44	398	23,293	137,458	347,689	199	17,351	94,492	264,864	169	15,227	88,846	224,487	68	2,645	0	0	237	17,872
2030																							
Total	487,737	0.54	33.2	0.32	0.69	8,450	520,403	3,441,338	7,409,591	5,115	410,684	2,585,127	5,880,075	4,489	366,374	2,442,673	4,998,423	998	43,265	46	1,281	5,532	410,920

An ore stockpiling strategy is practiced. The mine plan considers the value of the blocks mined on a continuous basis combined with the expected concentrates quality. From time to time ore material with a lower NSR value will be stockpiled to bring forward the processing of higher-value ore earlier in the life of mine. In some instances, the ore is segregated into stockpiles of known composition to allow for blending known quantities of material at the stockpile as required by the mill/customer. Stockpiling at Peñasquito also allows for forward planning for ore quality to ensure optimal mill performance and consistent gold production to match, within the normal bounds of expected variability within the mine plan. See Table 16-5.

Table 16.5: Peñasquito - LoM Open Pit Production

Year	Total Tonnes Mined (000)	Tonnes Mined Per Day	Oxide Ore Mined (000)	Gold Grade (g/t)	Silver Grade (g/t)	Sulphide Ore Mined (000)	Gold Grade (g/t)	Silver Grade (g/t)	Lead Grade (%)	Zinc Grade (%)	Gold Cont'd (000 oz)	Silver Cont'd (000 oz)	Lead Cont'd (000 oz)	Zinc Cont'd (000 oz)	Waste Tonnes (000)	Sulphide Stripping Ratio
2018	200,246	548,620	4,681	0.41	22.4	28,189	0.35	27.4	0.27	0.51	380	28,202	168,715	316,946	167,376	5.9
2019	199,542	546,692	72	0.73	53.3	52,541	0.45	39.9	0.45	0.72	765	67,577	521,704	832,455	146,929	2.8
2020	200,113	546,756	158	0.85	33.1	60,636	0.66	29.6	0.32	0.68	1,295	57,894	429,565	911,643	139,319	2.3
2021	172,075	471,439	278	0.18	16.9	47,145	0.77	30.3	0.26	0.71	1,168	46,147	270,436	735,815	124,652	2.6
2022	174,605	478,369	2,867	0.27	18.4	16,490	0.61	30.5	0.22	0.55	347	17,884	79,750	200,318	155,247	9.4
2023	172,836	473,524	848	0.32	15.3	28,333	0.38	34.9	0.32	0.72	358	32,192	199,215	450,727	143,655	5.1
2024	158,144	432,087	0	0.00	0.0	40,541	0.55	36.0	0.24	0.82	720	46,972	217,483	729,246	117,603	2.9
2025	146,216	400,593	48	0.74	35.7	45,669	0.74	34.7	0.41	0.81	1,087	50,943	416,484	818,672	100,499	2.2
2026	116,532	319,265	0	0.00	0.0	50,579	0.41	41.5	0.33	0.79	664	67,460	371,916	881,117	65,953	1.3
2027	84,544	231,626	0	0.00	0.0	38,778	0.50	31.7	0.36	0.61	624	39,463	310,708	524,185	45,766	1.2
2028	80,510	219,972	0	0.00	0.0	51,339	0.49	29.0	0.23	0.59	806	47,846	263,180	670,866	29,170	0.6
2029																
Total	**1,705,363**		**8,954**	**0.36**	**20.77**	**460,239**	**0.55**	**33.6**	**0.32**	**0.70**	**8,213**	**502,580**	**3,249,156**	**7,071,988**	**1,236,170**	**2.7**

Peñasquito - Stockpiles Open Balance

Year	Total Tonnes Mined (000)	Tonnes Mined Per Day	Oxide Ore Mined (000)	Gold Grade (g/t)	Silver Grade (g/t)	Sulphide Ore Mined (000)	Gold Grade (g/t)	Silver Grade (g/t)	Lead Grade (%)	Zinc Grade (%)	Gold Cont'd (000 oz)	Silver Cont'd (000 oz)	Lead Cont'd (000 oz)	Zinc Cont'd (000 oz)
2018						27,483	0.39	26.9	0.32	0.56	342	23,795	192,139	337,475
Total Ore						**487,722**	**0.54**	**33.19**	**0.32**	**0.69**	**8,555**	**526,375**	**3,441,295**	**7,409,464**

16.4 Blasting and Explosives

Drilling for all materials is on 15 m benches drilled with 1.0 to 1.5 m of sub-drilling. Drill patterns range from 8.00 m x 9.00 m in overburden to 5.00 m x 5.50 m in sulphide ore.

Blasting is carried out primarily with conventional ANFO explosives, supplied by an explosives contractor. Appropriate powder factors are used to match ore, waste, and overburden types.

16.5 Mining Equipment

Open pit mining is undertaken using a conventional truck-and-shovel fleet. A list of the major open pit equipment is shown in Table 16-6. Maintenance of mine equipment is covered by MARC contracts. The current loading capacity of the mining fleet is sufficient for the current 11-year LOM; however, additional haul trucks will need to be added to the fleet over the next several years as the haulage profiles continue to increase with greater pit depths and distance to the waste dumps.

A life of mine plan for the pits is shown in Figure 16-2 with the respective cross-sections shown in Figures 16-3 and Figure 16-4. The configuration of the waste dumps, as mining progresses is shown in Figure 16-5

Table 16.6: Peñasquito - Major Open Pit Equipment

Group	2018 Number of Units	LOM Average Number of Units	LOM Average Availability (%)	LOM Average Utilization (%)
Bucyrus BE495 Electric Rope Shovel 72 yd3 Bucket	4	4	86	78
Caterpillar 7495 electric Rope Shovel 78 yd3 Bucket	1	1	86	78
Caterpillar 24M Grader	5	5	75	61
Komatsu Track Dozer D375	4	4	90	83
Komatsu Track Dozer D475	11	11	79	85
FLEXIROCK D65 Drill - 4 1/2"	4	4	84	36
Komatsu 825A Grader	4	4	81	75
Hitachi EX2500 PC	1	0	73	56
Atlas Copco DML Drill - 9 7/8"	1		87	32
Atlas Copco DML Drill - 7 7/8"	2		87	32
Komatsu 930E Haul Trucks	85	83	89	79

Group	2018 Number of Units	LOM Average Number of Units	LOM Average Availability (%)	LOM Average Utilization (%)
Komatsu PC5500 Hydraulic Shovel	1	1	79	74
Komatsu PC8000 Hydraulic Shovel	2	2	81	51
Komatsu WA1200-3 Front Loaders	4	4	77	71
Komatsu W600 Front Loader	1	1	79	84
Atlas Copco Pit Viper 271 Drill - 10 5/8"	1	1	85	50
Atlas Copco Pit Viper 351 Drill - 10 5/8", 12 1/4"	9	8	87	50
Retroexcavadora PC300	1	1	84	33
Retroexcavadora PC390	1	1	84	33
Retroexcavadora PC390-10	1		84	33
Komatsu Excavators PC450	1		84	33
Telsmith Mobile Crusher	1	1	77	64
Caterpillar Vibrocompactador CAT CS683, 815F	1	1	99	16
Komatsu Water Truck HD930	2	2	85	74
Komatsu Water Truck HD785	7		85	66
Komatsu Wheel Dozel WD900	7	7	87	81
Caterpillar 777E Haul Truck	10	10	85	66
Caterpillar Track Dozer D11	3		79	

Figure 16.2: LOM Mine Plan Sequence.

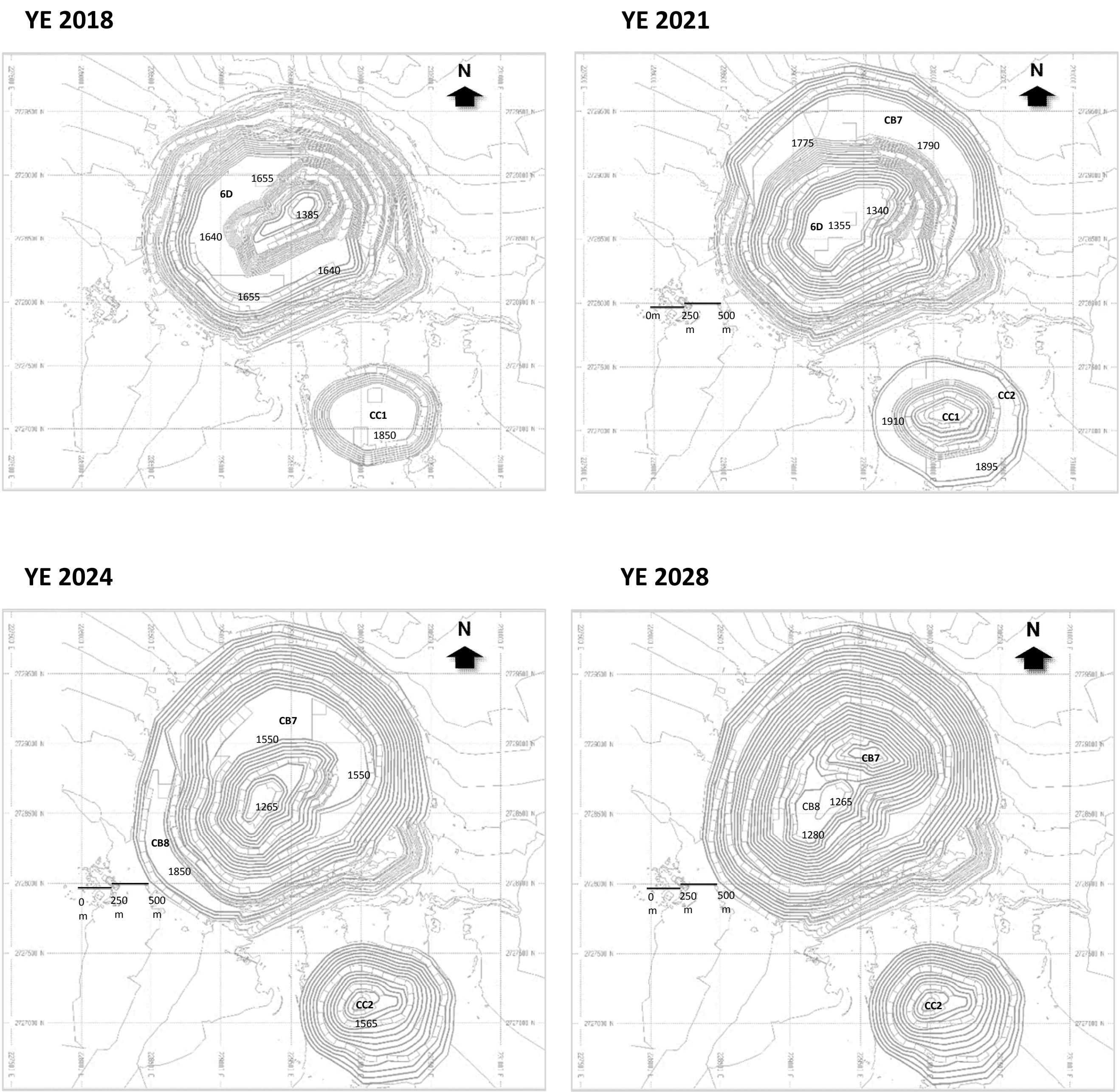


Figure 16.3: Final Pit's Cross Section Locations – Plan View

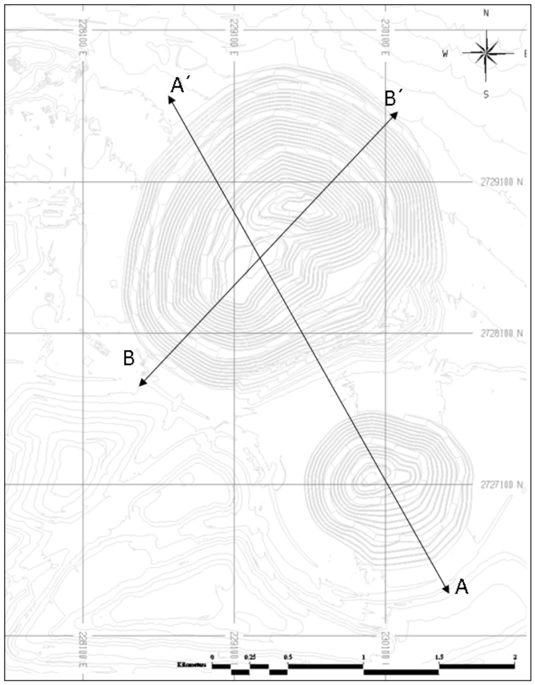


Figure 16.4: Cross section A-A' looking to SW

A-A´

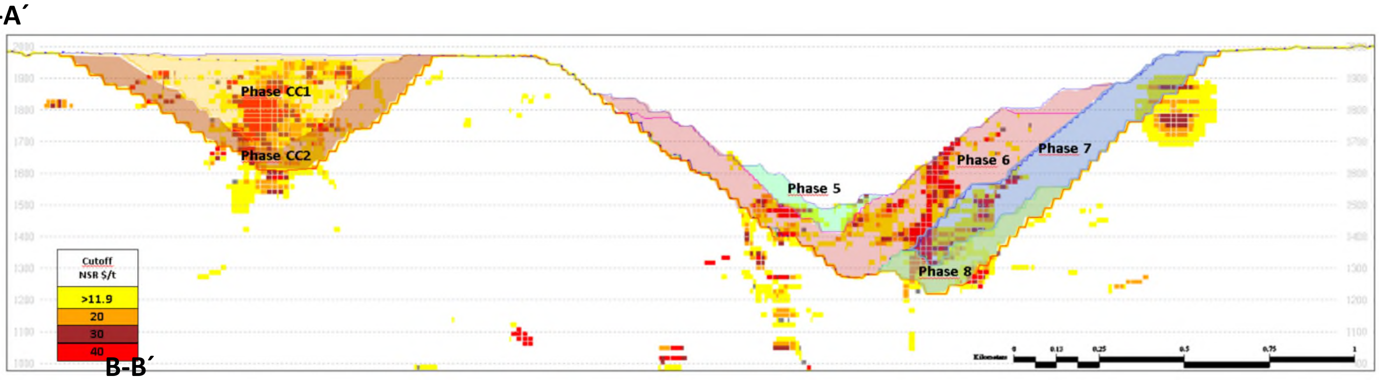


Figure 16.5: Cross section B-B' looking to NW

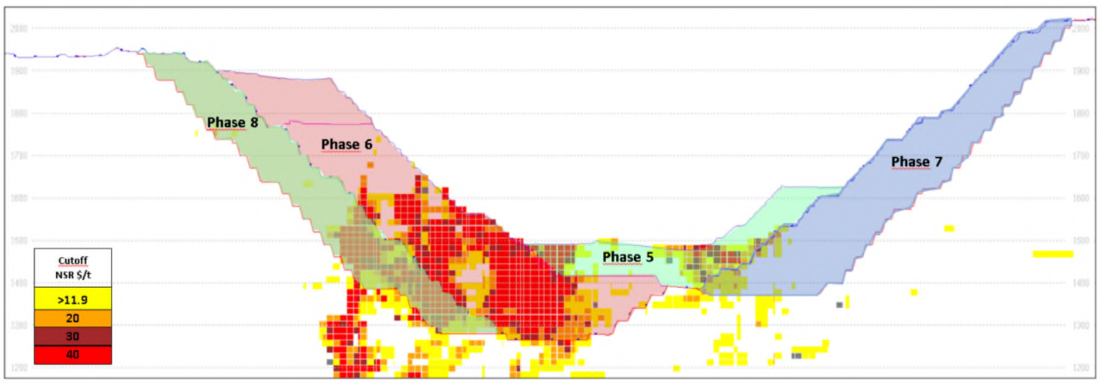
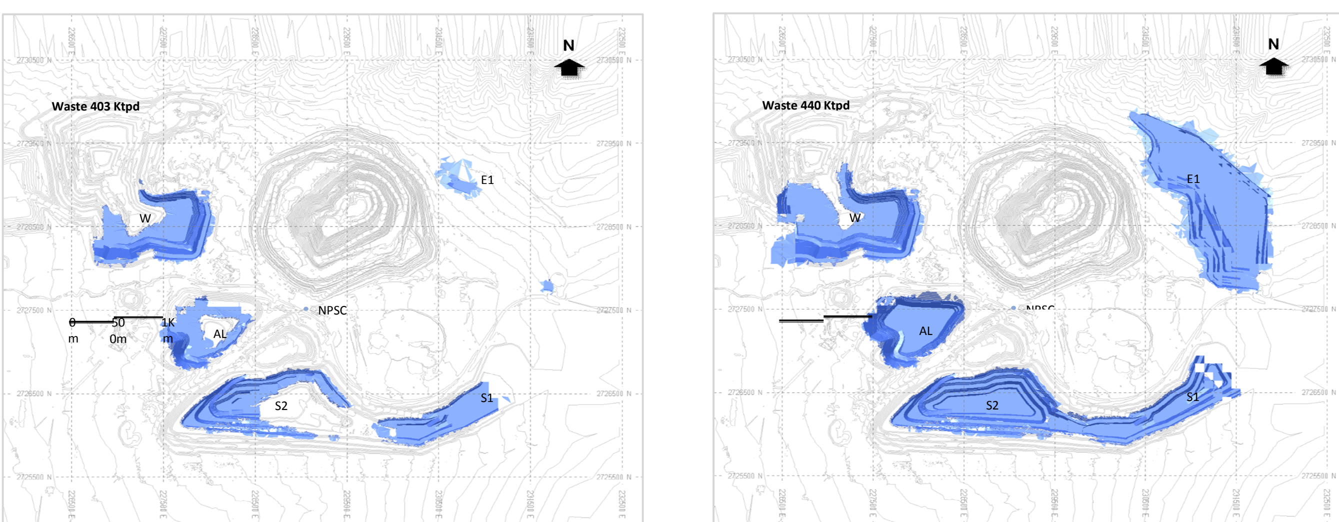
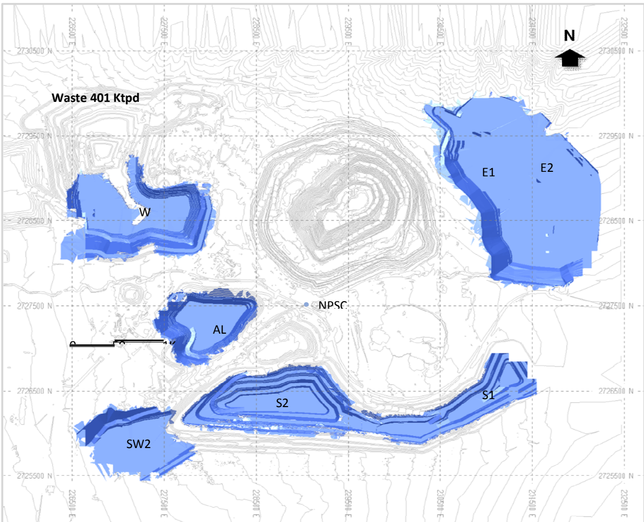


Figure 16.6: LOM Waste Dumps Sequence.

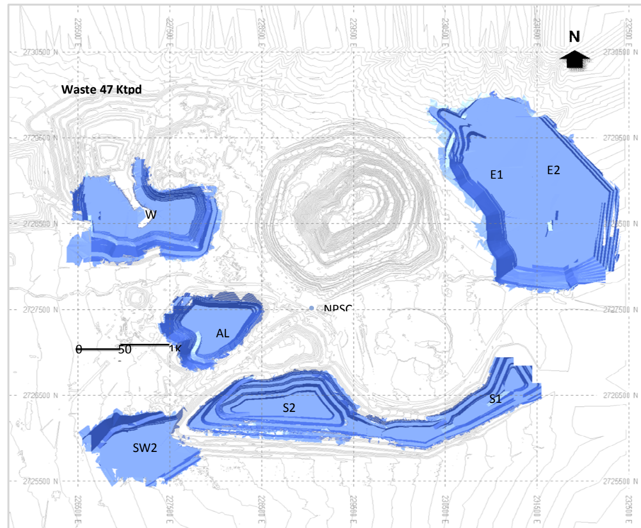
YE 2018 **YE 2021**



YE 2024



YE 2027



- W - West WD
- S1 - South 1 WD
- S2 - South 2 WD
- AL – Aluvion WD
- E1 – East WD
- E2 – East WD
- NPSC – Sizer
- BT – Buttre

16.6 Comment on Section 16

In the QP's opinion, the mining methods, equipment, overall design and the production rate assumptions used to develop the LOM plan and the Mineral Reserves are reasonable and achievable.

With any large open pit mining operation, efforts to further improve the efficiency of the operation should continue and would include:

- Further improvement of the geotechnical understanding of the pit slopes as the pit evolves and the high walls increase in height;
- Continued optimization of waste dump placement and material movement to reduce unit operating costs;
- Efforts to increase the productivity of the mining fleet in order to further reduce mining unit costs; and
- Given the complex nature of the ore, continued efforts on grade control procedure to optimize the quality of the mill feed.

17.0 RECOVERY METHODS

17.1 Process Flow Sheet

The Peñasquito Operations consist of a heap leach gold and silver recovery facility that can process a nominal 25,000 t/d of oxide ore and a sulphide plant that processes a nominal 124,000 t/d of sulphide ore.

The oxide flowsheet is included as Figure 17-1. A schematic of the sulphide process flowsheet is included as Figure 17-2.

17.2 Plant Design

17.2.1 Oxide Ore

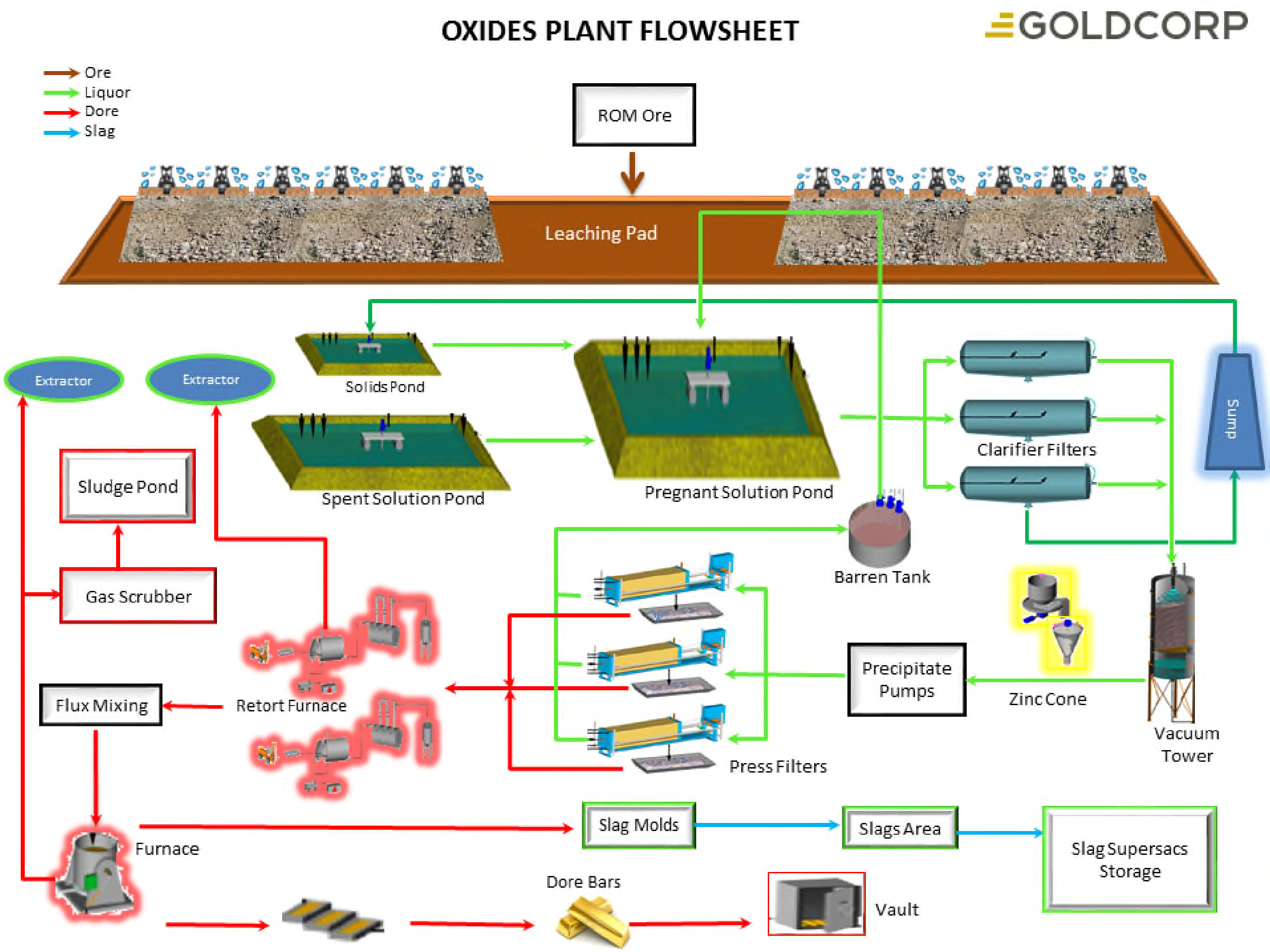
Run-of-mine (ROM) ore is delivered to the heap leach pile from the mine by haul trucks. Lime is added to the ore, prior to addition of the ore to the pad. Ore is placed in 10 m lifts and leached with cyanide solution. Pregnant leach solution is clarified, filtered, and de-aerated, then treated with zinc dust to precipitate the precious metals. The precipitated metals are subsequently pressure filtered, and the filter cake smelted to produce doré as final product.

17.2.2 Sulphide Ore

ROM ore is delivered to the crusher dump pocket from the mine by 290 t rear-dump–haul trucks. The crushing circuit is designed to process 136,000 t/d of ROM ore to 80% passing 150 mm. The crushing facility consists of a gyratory crusher capable of supporting the 92% utilization on a 24-hour-per-day, 365-days-per-year basis of the processing plant. A near-pit sizing conveyor (NPSC) has since been included to support higher throughput by facilitating waste removal.

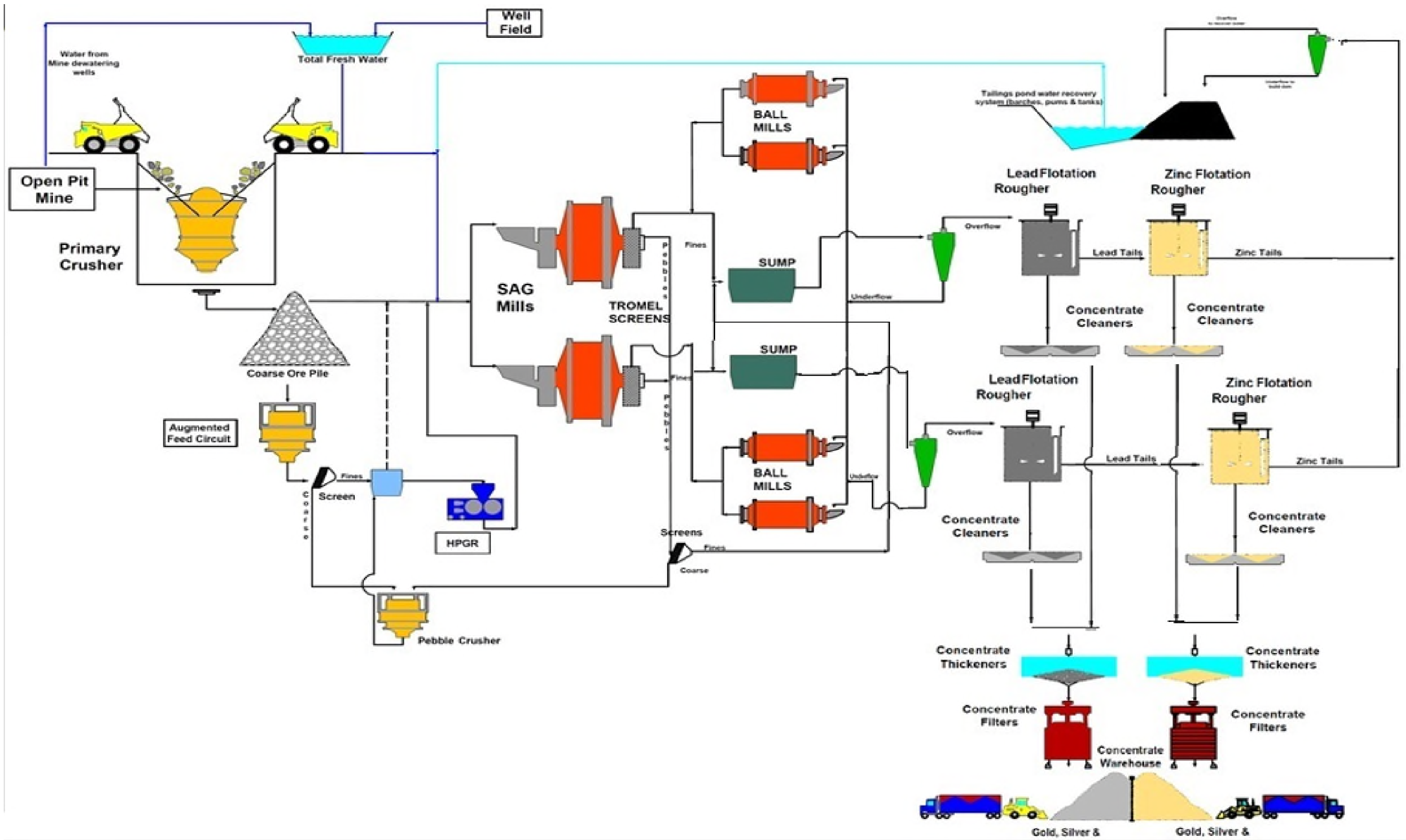
Product from the gyratory crusher discharges into a 500 t surge pocket directly below the crusher. The crusher feeds, via an apron feeder, a coarse ore stockpile that has a 91,800 t live capacity. A total of ten apron feeders arranged in two lines, of five feeders each, reclaim ore from the coarse ore stockpile. Nine feeders report the coarse ore to two semi-autogenous grind (SAG) mills operating in closed circuit with pebble crushers and one HPGR. Each SAG mill operates with two ball mills.

Figure 17.1: Oxide Flowsheet



Note: Figure prepared by Goldcorp, 2015.

Figure 17.2: Simplified Schematic Sulphide Flowsheet



Note: Figure prepared by Goldcorp, 2013.

The pebble crushing circuit includes three cone crushers working in parallel and one HPGR unit working in tandem with the cone crushers. An augmented crusher is fed directly with coarse ore stockpile material by a single apron feeder and the product is dry screened. The oversize from the augmented crusher screen together with the oversize from the SAG trommel screens constitutes the feed to the pebble cone crushers. The pebble crusher product together with the fines produced by the augmented crusher screen are discharged to a bin that feeds the HPGR or, when necessary, feeds directly to the SAG mills.

Each grinding circuit reduces the crushed ore from a passing P80 of 159 mm size to a passing P80 of 125 µm. The SAG trommel screen undersize (minus 19 mm material) discharges to a common sump. Secondary grinding is performed in four ball mills, operating in closed circuit with cyclones. Ball mill discharge is combined with SAG mill trommel screen undersize and the combined slurry is pumped to the primary cyclone clusters. Cyclone underflow reports back to the ball mills. Cyclone overflow flows by gravity to the flotation area as final grinding product. The flotation area is comprised of carbon, lead and zinc flotation circuits.

The carbon pre-flotation circuit consists of two banks each with two cells of rougher in parallel. Carbon rougher concentrate proceeds to a single bank of three cleaner cells. The cleaner concentrate is treated in a single re-cleaner column, while the cleaner tails flow to a single bank of three cleaner-scavenger cells. Cleaner-scavenger concentrate returns to the cleaner circuit, while cleaner-scavenger tails are mixed with rougher tails which then become feed to the lead circuit. The recleaner column concentrate will proceed to final tails until the tertiary precious metals recovery circuit is installed.

The lead rougher flotation consists of six rows of rougher flotation machines in parallel, each row consisting of five cells. Lead rougher concentrate is pumped to the lead regrind mill circuit or bypassed directly to the lead cleaner conditioning tank. Tailings from the lead rougher cells flows by gravity to the zinc rougher conditioner tanks. This material is conditioned with reagents to activate the sphalerite and associated precious metals. Rougher lead concentrate is reground in closed circuit with cyclones. Product at a passing P80 of 30 µm is cleaned in a three-stage cleaner circuit. Reagents are added into the rougher and cleaner circuits on as-required basis.

Tailings from the lead circuit flow by gravity to the zinc rougher conditioner tanks. One conditioner tank is installed for each bank of zinc rougher flotation cells. The conditioner tanks provide retention to facilitate activation of the sphalerite by copper sulphate addition. Isopropyl ethyl thionocarbanate (IPECT) is added to collect the zinc associated with activated sphalerite. Frother is added as required.

The slurry in the conditioners overflow to the zinc rougher flotation circuit, which consists of six banks of six tank-type, self-aerating, rougher flotation cells. Tailings from all rows of zinc rougher cells are combined in a tailings box and flow by gravity to a tailings pond. The rougher zinc concentrate is reground in vertical mills operating in closed circuit with cyclones.

Product at a passing P80 of 30 µm is cleaned in a three-stage cleaner circuit. Reagents are added into the cleaner flotation cells as required.

Final lead and zinc concentrates are thickened, pressure filtered, and trucked to inland smelters or to ports for overseas shipment.

Table 17-1 list the major equipment currently operating at the Peñasquito process plant.

Table 17.1: Major Equipment List

Equipment	Parameter	Value
Crushing and Grinding		
Primary Crusher	Type	FFE – Gyratory Crusher
	Size	60" x 113"
Conveyor Belts	Width	72"
Coarse Ore Stockpile	Live Capacity	91,800 t
	Total Live Capacity	238,800 t
Apron Feeders	Quantity	5 per line
	Dimensions	48" x 17"
Augmented Crusher	Type	Cone crusher
	Model	Raptor XL 1100
	Motor	820 kW
SAG Mill	Quantity	2
	Type	FFE – SAG gearless
	Size	11.6 m x 6.1 m
	Motor	19,400 kW
Ball Mill	Quantity	4 (2 lines)
	Type	FFE – Ball mill
	Size	7.3 m x 11.3 m
	Motor	6,000 kW synchronous
Cyclones	Quantity	24 (4 cyclobanks)
	Type	G-max 33
Pebble Crusher	Quantity	3
	Type	Sandvik CH880
	Motor	600 kW
HPGR	Quantity	1
	Type	Polycom 24/17"
	Motor	5,000 kW
Carbon Pre-Flotation Circuit		
Rougher flotation	Type	Outotec
	Quantity	2 banks of 2 cells
	Volume	630 m^3
Cleaner flotation	Type	Outotec
	Quantity	1 bank of 3 cells
	Volume	300 m^3
Scavenger flotation	Type	Outotec
	Quantity	1 bank of 3 cells
	Volume	300 m^3
Re-cleaner flotation	Type	Outotec
	Quantity	1 column cell
	Dimensions	5,5 m diameter x 14 m

Equipment	Parameter	Value
Lead Flotation Circuit		
Rougher flotation	Type	Wemco/Dorr Oliver
	Quantity	30 (6 rows, 5 cells per row)
	Volume	250 m^3
1st Cleaner	Quantity	7
	Volume	42.5 m^3
2nd Cleaner	Quantity	8
	Volume	2.5 m^3
3rd Cleaner	Quantity	4
	Volume	2.5 m^3
Vertical mill	Quantity	2
	Type	Metso – 485 kW
Zinc Flotation Circuit		
Rougher flotation	Type	Wemco/Dorr Oliver
	Quantity	36 (6 rows, 6 cells per row)
	Volume	250 m^3
1st Cleaner	Quantity	7
	Volume	42.5 m^3
2nd Cleaner	Quantity	8
	Volume	8.5 m^3
3rd Cleaner	Quantity	5
	Volume	8.5 m^3
Vertical mill	Quantity	2
	Type	Metso – 485 kW
Lead Conc. Thickening		
Thickener	Quantity	2
	Type	Outokumpu – High Rate
	Size	10 m (32.81 ft.) dia
Storage Tank	Quantity	2
	Size	325 m^3
Zinc Conc. Thickening		
Thickener	Quantity	2
	Type	Outokumpu – High Rate
	Size	14 m (45.93 ft.) dia
Storage Tank	Quantity	2
	Size	325 m^3
Lead Concentrate Filtering		
Filters	Type	Pneumapress 14 plates
	Size	2.8 m^2
	Quantity	3
Zinc Concentrate Filtering		
Filters	Type	Pneumapress 14 plates
	Size	2.8 m^2
	Quantity	3

Equipment	Parameter	Value
Tailings Classification		
Cyclone Towers	Quantity	2 (north tower & south tower)
Cyclone feed pumps	Type	600 mm x 650 mm GIW
	Quantity	3 per tower
Cyclone cluster	Type	Gmax 20
		15 cyclones per cluster
		2 clusters per tower

17.3 Plant Operation

The plant production statistics from 2010 to the end of second quarter of 2018 are shown in Table 17-2 for oxide material and in Table 17-3 for sulphide material.

Metallurgical accounting is practiced using appropriate samplers and flow-rate measurements throughout the circuit.

17.4 Energy, Water, and Process Materials Requirements

17.4.1 Energy

Peñasquito site currently uses power sourced from the Mexican Electricity Federal Commission (Comision Federal de Electricidad) as its central power grid. The annual power consumption ranges from 130 MW to 145 MW per day, where the processing plant accounts for around 85% of the total consumption.

17.4.2 Reagents

Table 17-4 indicates the types and locations of major areas of reagent use. Reagents are typically trucked to site and stored onsite in quantities sufficient for mine usage, plus a three to seven days supply to cover potential interruptions in the delivery of the reagents.

17.4.3 Water Supply

At Peñasquito, water is sourced from several locations: the tailings storage facility (TSF), well fields, pit dewatering wells, and process operational recycle streams.

The operating philosophy at Peñasquito is to maximize the amount of recycled water within the process plant, and a significant proportion of the total mine site water requirements is made up from recycled water. Fresh water is used only for reagent makeup and gland service water for the pumps.

Additional information on Project water supply is included in Section 20.

Table 17.2: Plant Product Statistics – Oxide

	2010	2011	2012	2013	2014	2015	2016	2017	2018 (Jan-Jun)
Ore processed (dmt)	10,540,200	11,126,000	6,789,741	14,388,191	2,422,145	3,132,922	947,180	0	1,679,745
Au Produced (Oz)	78,400	55,800	42,700	62,262	36,561	27,565	15,321	2,358	3,032
Ag Produced (Oz)	3,006,200	1,891,000	1,420,300	1,684,105	931,641	642,245	274,927	47,283	56,533

Table 17.3: Plant Product Statistics – Sulphide

	2010	2011	2012	2013	2014	2015	2016	2017	2018 (Jan-Jun)
Ore processed (dmt)	20,637,600	30,999,200	36,406,900	38,762,400	39,913,100	38,870,110	34,111,873	37,083,413	18,044,053
Pb Concentrate (dmt)	79,800	132,500	144,900	155,100	154,200	159,318	117,577	140,255	55,756
Zn Concentrate (dmt)	143,700	258,300	298,400	267,200	328,000	311,600	273,365	336,655	153,985
Au Grade (g/t)	0.27	0.37	0.50	0.45	0.65	1.00	0.70	0.66	0.48
Au Rec (%)	48	61	69	67	71	73	65.47	69.17	70.01
Au Produced (Oz)	89,800	198,300	368,600	375,700	596,600	832,711	502,637	526,972	184,503
Ag Grade (g/t)	27.57	26.20	27.41	23.95	26.78	28.25	22.98	23.51	22.20
Ag Rec (%)	58	74	77	78	82	80	78.80	82.57	83.93
Ag Produced (Oz)	10,946,400	17,154,500	22,284,500	23,180,900	28,285,500	25,284,334	19,861,579	23,148,114	10,810,250
Pb Grade (wt%)	0.38	0.34	0.28	0.27	0.25	0.30	0.22	0.23	0.19
Pb Rec (%)	60	70	74	73	76	72	71.92	74.73	75.0
Pb Produced (klb)	97,400	154,700	153,700	179,600	177,700	173,854	117,871	141,370	57,260
Zn Grade (wt%)	0.63	0.64	0.62	0.52	0.56	0.68	0.54	0.64	0.59
Zn Rec (%)	65	76	77	73	79	79	77.51	81.20	83.44
Zn Produced (klb)	154,500	286,400	324,200	349,800	410,800	388,768	317,568	424,362	197,401

Table 17.4: Major Reagents and Usages

Area	Reagent	Duty
Lead flotation	SIPX90	Sulphide collector
	Aerofloat 7310	Enhanced gold and silver collector
	Aerophine 3418A -	Galena and precious metals collector
	Sodium cyanide	Depression of iron sulphides
	Deprezinc (zinc liquor)	Sphalerite depression
	Cromalux 251	Carbon depressant
	MIBC + glycol	Frother
Zinc flotation	F1234 - IPETC	Enhanced sulphide collector
	Copper sulphate solution	Zn activator
	MIBC + glycol	Frother
General	Flocculant	Assist settling in thickener

17.5 Pyrite Leach Process (PLP)

The PLP circuit is under construction and will be incorporated as an add-on to the existing sulphides process plant at Peñasquito to process gold/silver pyrite-dominated sulphide tailing from the existing Peñasquito sulphides final tailings. The overall plant design has been prepared using the feed scenarios expected during the LOM. Process and equipment design is based on laboratory results from the various levels of testwork semi-continuous and batch.

The projected production plan for the PLP circuit is planned for 2018 and covers a mine plan from 2018 to 2027. A series of metallurgical composites were prepared by Goldcorp Peñasquito Technical Services to reflect the feed stock variations in mineralogy, head grade and expected metallurgical response representative of 2018 to 2024 (based upon available representative drill core material). ALS Metallurgy, Kamloops, BC, performed pilot plant flotation tests and extensive confirmatory grinding and leaching tests. The plan contemplates a design pyrite leach plant feed of 5,887 t/h and a plant availability of 92%.

Numerous variations in mineralogy, head grade (specifically % S in the feed stream) and metallurgical response will cause potential fluctuations in the rougher and cleaner concentrate grades and metal recovery. Similarly, the performance of the regrind mill circuits, agitated leach extraction, and CCD washing efficiency will also be affected. Therefore, equipment specification includes a percentage variation allowance in both the feed and throughput characteristics.

The PLP circuit will treat the zinc rougher tailing from the existing Peñasquito concentrator for recovery of residual gold and silver. The process is comprised of pyrite rougher and cleaner flotation, pre-cleaner concentrate regrinding, pyrite thickening, and post-cleaner regrind, agitated tank leaching, counter-current decantation, Merrill-Crowe precipitation, precious metals refining and a cyanide detoxification circuit. The PLP circuit produces doré bars with its tailing streams reporting to the existing tailing trench

Major equipment list for the PLP circuit is presented in Table 17.5.

Table 17.5: PLP Circuit Major Equipment and Key Design Parameters

Parameter	Value
Annual ore throughput	47,450,000 t/y
Overall availability and utilisation	92%
Overall recovery: Au / Ag	35.7% / 49.1%
Flotation recovery: Au / Ag	78.5% / 73.9%
Leach recovery: Au / Ag	53.7% / 80.9%
Rougher flotation	
Residence time	28 min.
Cell arrangement	3 banks of 5 630 m^3 tank cells
pH	7.7 as received

Parameter	Value
Pre-cleaner regrind	
Configuration	Vertical mill in open circuit
Recirculating load	none
Installed power	3.5 MW
Product size	50 – 60 microns
Cleaner flotation	
Residence time	12.8
Cell arrangement	Single bank of 3 cells
pH	7.7 as received
High Rate Thickening	
Diameter	35 m
Underflow solids	70% wt.
Flocculant	15 g/t
Post-Cleaner Regrind	
Mill type	ISAMILL
Number of mills	4
Product Size Target (P_{80})	<30 μm
Pre-Leach Flotation	
Residence time	5 min
Cell arrangement	Single bank of three 130 m^3 cells
Leach Circuit	
Residence time	24 h
Solids density	45% wt.
Number of tanks	1 pre-aeration / 5 leaching
pH	10.5 - 11
Counter Current Decantation	
Number of stages (thickeners)	5 high rate
Diameter	30 m
Underflow solids	55% wt.
Flocculant (per stage)	35 / 25 / 20 / 15 / 15 g/t
Cyanide Detoxification	
Solids in feed	45% wt.
Free CN^- and CN_{WAD} in feed	122 and 642 mg/L
Residence time	4 h
Treatment method	Air / SO_2
Number of tanks	2 in series.
Metal recovery (Merill-Crowe)	
Design flow	1969 m3/h
Clarification filters (horizontal pressure)	5 operating / 1 standby
Precipitation agents	Zinc powder / Lead nitride sol.

Parameter	Value
Precipitation filters (plate and frame)	5 operating / 1 standby

17.6 Tertiary Precious Metals Recovery Process

The Tertiary Precious Metals Recovery circuit is required to minimize precious metal lost with the CPP carbon concentrate, and to indirectly recover precious metal value associated with the PLP pre-leach flotation concentrate, which will be directed to the CPP cleaner flotation cells. Without the Tertiary Precious Metals Recovery, the carbon concentrate and contained gold and silver values will be directed to tailings. Final carbon concentrate from CPP, currently designed to go to tailings, will be directed to a gravity concentration circuit, consisting of 32 ultrafine gravity concentrators operating in parallel.

Feed from CPP will be pumped to a pressurized distributor that will divide the dilute slurry into eight concentrator feed tanks. Each of the feed tanks will supply slurry to the four associated gravity concentrators. The concentrators will produce a precious metals concentrate that is collected in a single pumpbox and pumped to both trains of the lead cleaner circuit. The concentrator tail will be collected in a launder and sent to final tailings by gravity. A sampler will be located on the tailing discharge for metallurgical accounting.

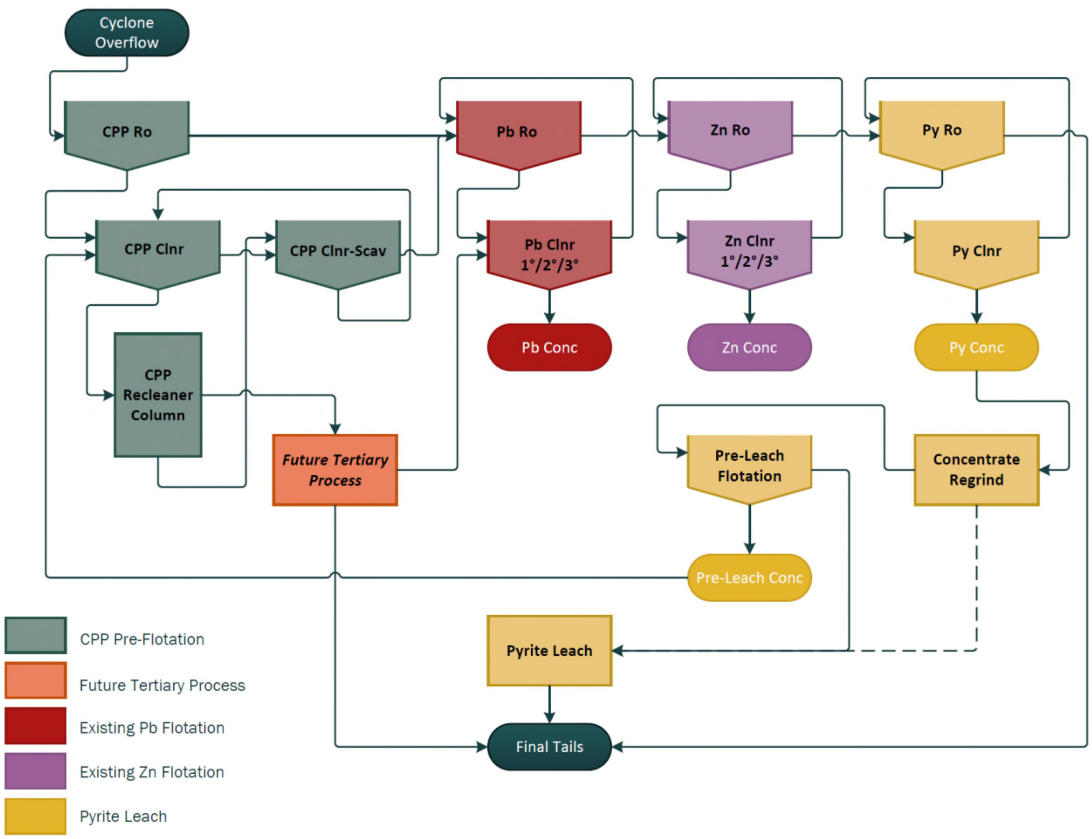
Ancillary services will include:

- Dedicated low pressure compressors to deliver plant air
- Fresh water will be fed from the existing system, pumped and filtered to be turned into gland water
- Gland water delivery system for the new concentrate pumps will be fed from the new fresh water system
- Gland water delivery system for the flush water to the gravity concentrators
- Process water for hose stations will be tied into the existing system
- Instrument dry air will be fed from the new high pressure dedicated compressors to the individual gravity concentrators

The UF Falcon units are rated to handle 20 m^3/hr of slurry, with 32 operable units the maximum design flow would thus be 640 m^3/hr. The unit capacities are based on volumetric loading, with recommended solids densities in the feed between 5 – 15%. Based on testwork carried out to date, pulp densities in the feed to the UF Falcon are likely to be in the range of 5% and contained solids less than 30 tph.

Figure 17.3 is a simplified schematic representation of the overall sulphide process flowsheet incorporating existing lead and zinc flotation, the recently completed carbon pre-flotation process, as well as the pyrite leach process and tertiary process which are both currently under construction.

Figure 17.3: Simplified Overall Process Flowsheet



17.7 Comments on Section 17

The Peñasquito Operations consist of a leach facility that can process a nominal 25,000 t/d of oxide ore and a sulphide plant that processes a nominal 124,000 t/d of sulphide ore.

Plant operations at the designated throughput rates are dependent on both reagent delivery, and power and water supply being available on a continuous, and uninterrupted, basis.

The Carbon Pre-Flotation Process was commissioned and placed into operation during the second quarter of 2018. The PLP will be commissioned during the third quarter of 2018.

The Tertiary Precious Metals Recovery Project, an add-on to the Carbon Pre-Flotation Process is under construction and expected to be commissioned in early 2019.

18.0 PROJECT INFRASTRUCTURE

The general location of the main infrastructure in relation to the tenure boundaries is shown in Figure 18-1. A detailed aerial photograph showing the current plant and mine layout is included as Figure 18-2.

The camp and accommodation is comprised of a 3,421-bed camp with full dining, laundry and recreational facilities. All required Project infrastructure, such as roadways, mine and administration buildings, process plant, explosives storage facility, fuel farm, truckshop, workshops and security, has been constructed and is operational.

18.1 Road and Logistics

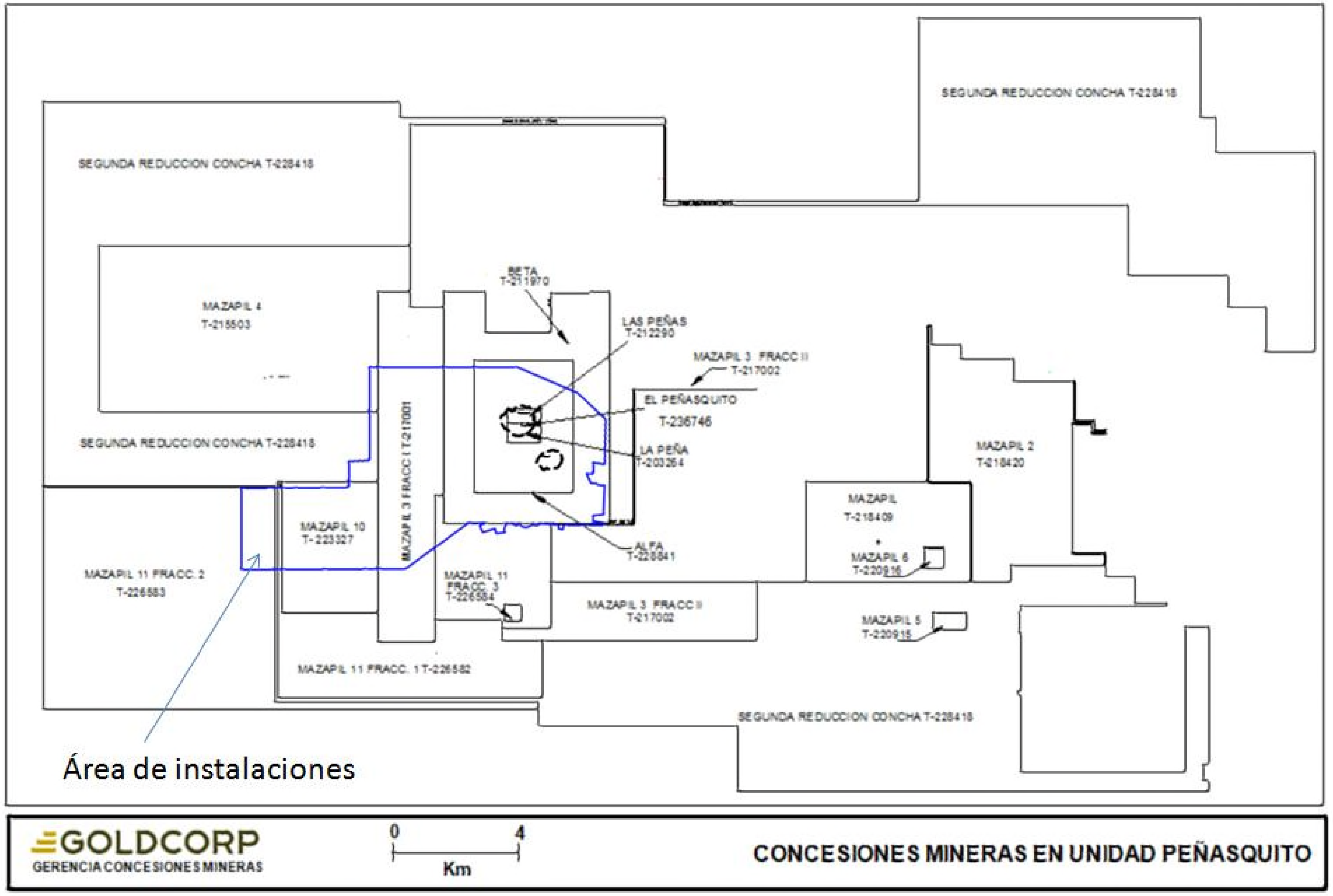
Project access is discussed in Section 5.

18.2 Surface Infrastructure

Site infrastructure comprises:

- Two open pits: Peñasco and Chile Colorado;
- Three waste rock dumps (with conveying and stacking system for the near-pit sizer–convey (NPSC) waste dump);
- One concentrator plant and associated conveying systems;
- One heap leach pad and Merrill Crowe plant;
- Camp / accommodation complex;
- Maintenance, administration and warehouse facilities;
- Tailings storage facility (TSF);
- Medical clinic;
- Various ancillary buildings;
- Paved airstrip;
- Diversion channels;
- Pipelines and pumping systems for water and tailings;
- Access roads;
- Explosive storage facilities;
- High-voltage transmission line; and
- Environmental monitoring facilities.

Figure 18.1: Project Infrastructure Layout in Relation to Mineral Tenure



Note: Blue outline labelled "area de instalaciones" is the approximate area of infrastructure shown in the satellite image in Figure 18-2. The outlines of the Peñasco and Brecha Azul breccia pipes are indicated as black dashed outlines. Figure dated 2011.

Figure 18.2: Air Photo Showing Current Project Infrastructure Layout

Note: Photograph shows a 2017 satellite image that illustrates the Project facilities layout, including the current TSF, open pit, waste rock storage facility, heap leach pad, and building infrastructure.

18.3 Power and Electrical

Power is currently supplied from the 182MW power purchase agreement with Intergen, delivered to the mine by the Mexican Federal Electricity Commission (Comisión Federal de Electricidad or CFE). CFE also continues to provide backup power supply for both planned and unplanned shutdowns from the Intergen power plant.

18.4 Comments on Section 18

The QPs note that the infrastructure required for current Project operation is in place.

19.0 MARKET STUDIES AND CONTRACTS

19.1 Market Studies

Goldcorp currently has an operative refining agreement with Met Mex Peñoles for refining of doré produced from the Project. Goldcorp's bullion is sold on the spot market, by marketing experts retained in-house by Goldcorp. The terms contained within the sales contracts are typical and consistent with standard industry practice and are similar to contracts for the supply of doré elsewhere in the world. Part of the silver production is forward-sold to Wheaton PM (refer to Section 4.8).

The markets for the lead and zinc concentrates from Peñasquito are worldwide with smelters located in Mexico, North America, Asia and Europe. Metals prices are quoted for lead and zinc on the London Metals Exchange and for gold and silver by the London Bullion Market Association. The metal payable terms, and smelter treatment and refining charges for both the lead and zinc concentrate represent "typical" terms for the market.

The terms contained within the sales contracts are typical and consistent with standard industry practice and are similar to contracts for the supply of concentrates and doré elsewhere in the world.

Transportation contracts are in place for concentrate and doré transport and are managed by Minera Peñasquito. The terms contained within the contracts are typical and consistent with standard industry practices.

19.2 Forward Sales Agreements

As at 30 June 2018, Goldcorp has entered into forward sales agreements for the base metals volumes in relation to Peñasquito concentrate sales, as follows:

- Zinc
  - Contracts to sell 41.7 million pounds at an average price of $1.52 per pound in the next 12 months;
- Lead
  - Contracts to sell 19.2 million pounds at an average price of $1.16 per pound in the next 12 months.

19.3 Commodity Price Projections

Commodity prices used for Mineral Resource and Mineral Reserve estimates are set by Goldcorp Corporate.

19.4 Comment on Section 19

In the opinion of the QPs:

- The Project has demonstrated that the doré and lead and zinc concentrates produced are saleable;
- Goldcorp currently has an operative refining agreement for refining of doré produced from the Project;
- Part of the silver production is forward-sold to Wheaton PM;
- The markets for the lead and zinc concentrates from Peñasquito are worldwide with smelters located in Mexico, North America, Asia and Europe;
- Goldcorp has entered into forward sales agreements for the base metals volumes in relation to Peñasquito concentrate sales; and
- Commodity prices used in estimation of Mineral Reserves and in the financial analysis are appropriate, based on guidance provided by Goldcorp Corporate.

20.0 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT

20.1 Baseline Studies

The key baseline studies completed over the Project area in support of the original environmental assessment and later Project expansion included:

- Hydrogeology and groundwater quality;
- Aquifer assessments;
- Surface water quality and sediment;
- Metals toxicity and acid mine drainage studies;
- Air and climate;
- Noise and vibration;
- Vegetation;
- Wildlife;
- Conservation area management plan;
- Biomass and carbon fixation studies;
- Land use and resources;
- Socio-economics.

20.2 Environmental Considerations

Environmental monitoring is ongoing at the Project and will continue over the life of the operations. Key monitoring areas include air, water, noise, wildlife, forest resources and waste management.

Characterization studies of waste rock, pit walls, and tailings materials were undertaken to determine the acid rock drainage (ARD) and metal leaching (ML) potential. Peñasco and Chile Colorado waste rock was found to have low potential for acidic drainage from the oxidized waste rock lithologies. However, there was potential for waste rock with sulphides to oxidize to produce acidity; however, this could be controlled by adequate neutralization in these materials to overcome acidic drainage. Potentially acid-forming waste (PAG) materials and rock types that have ML potential are currently stored in the waste rock facilities and encapsulated with non-reactive rock. The tailings materials have somewhat higher potential to produce ARD and ML (selenium being the only metal potentially outside Mexican standards). Control of ARD and ML from tailings materials will be achieved through reclamation of the current tailings facility after its closure in 2027, concurrent with ongoing mining activities, and reclamation of the final tailings facility immediately after mine closure.

20.3 Waste Rock Storage

The approximately 1.24 billion tonnes of waste rock remaining to be mined in the LOM plan will be stored in a series of waste rock storage facilities as outlined in Figure 20-1. All of these facilities are located with Goldcorp's overall operating area. The development schedule for each facility is based on an optimization of the overall haulage profile, the requirements for waste material for tailing storage, and the incorporation of additional haulage trucks into the current mining fleet.

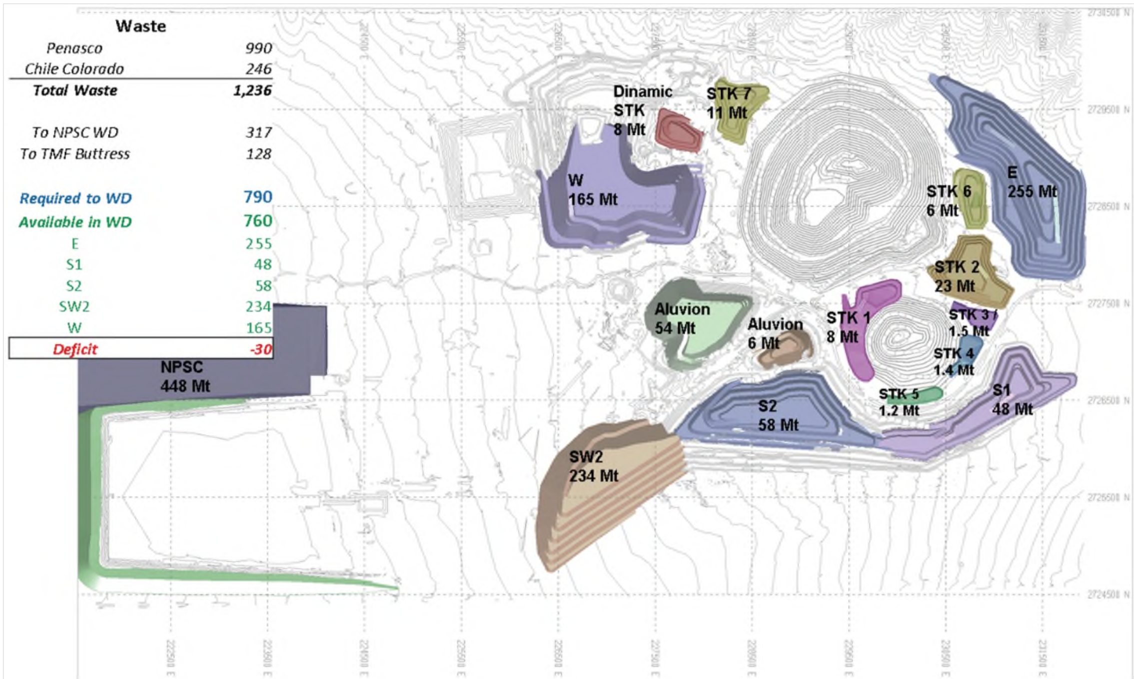
The current waste rock storage strategy does not consider any backfilling of pits such as Chile Colorado. All of the waste rock storage facilities are located well beyond the crest of the ultimate pit; however, further optimization of the LOM waste dumping plan will continue to be examined by Goldcorp in an effort to further reduce haulage profiles and resulting unit mining costs.

20.4 Tailings Storage Facility

The existing TSF is designed as a zero-discharge facility with the capacity to temporarily store excess water from mill operations and expected climatic conditions including the design storm event.

The current TSF has been designed to feasibility level and permitted to 1,908 m elevation. Concept studies were completed during 2017 that indicated that the current facility can be safely raised to 1,922 m elevation, adequate to store all LOM tonnage as indicated in June 30, 2017 Mineral Reserve statement. Based on the results of those studies, additional optimization to the centerline raise may be done in future in order to reduce construction costs and optimize factors of safety.

Figure 20.1: LOM Waste Rock Storage Facilities



Note: Figure prepared by Goldcorp, 2017.

20.5 Water Management

20.5.1 Water Sources

The mine is located in Mazapil valley, which forms part of the Cedros administrative aquifer. Hydrologically, this aquifer is part of the Nazas Aguanaval sub-basin, which forms part of the Laguna de Mayrán y Viesca Regional Basin. Because there are no surface water resources, the water supply for the Peñasquito Operations is obtained from groundwater in the Cedros basin, from an area known as the Torres and Vergel well field.

The mine has received permits to pump up to 40.287 Mm^3 of this water per year via eight water rights titles over the Torres and Vergel water well field and Northern Well field (NWF). The Torres and Vergel well field is being pumped at an average daily rate of 5,800 m^3 per day.

In 2017, the Peñasquito Operations recycled almost 77% of the water that was used in the mining and ore processing.

Goldcorp continues to monitor the local aquifers to ensure they remain sustainable. A network of monitoring wells has been established to monitor water levels and water quality.

20.5.2 Dewatering Activities

Dewatering wells from the open pit area are being pumped at an average rate of 13,600 m^3 per day. This water is used by the mine, plant, and leach pad as required.

20.5.3 Water Balance

A probabilistic water balance model has been developed for the entire mine site including the plant, heap leach facilities, diversion channels, tailings facility, other users of water, and the water supply system. The software used for this water balance is the industry standard GoldSim modeling package. This model is tracked and updated on a monthly basis. Modelling allows Goldcorp to define initial and operating conditions within the Peñasquito mine system and simulate the projected performance of the mine water system over a given time period.

The mine is operated as a zero-discharge system. Peñasquito does not discharge process water to surface waters, and there are no direct discharges to surface waters.

20.5.4 Waste Water

All wastewater from the mine offices, camp and cafeteria is treated in a wastewater treatment plant prior to discharge to the environment.

All storm water is diverted from the main infrastructure facilities through use of diversion channels.

20.6 Closure Plan

A closure and reclamation plan has been prepared for the mine site. The cost for this plan was calculated based on the standard reclamation cost estimator (SRCE) model which is based on the Nevada State regulations. The closure cost spending schedule has been updated for the current mine life, and reflects anticipated expenditures prior to closure, during decommissioning and during the post-closure monitoring and maintenance period. Site closure costs are funded by allocating a percentage of sales revenue to closure activities.

The closure and reclamation plan also incorporates international best practices, including the World Bank Environment, Health and Safety Guidelines Mining and Milling - Open Pit, the Draft International Finance Corporation (IFC) Environmental, Health and Safety Guidelines – Mining, and the International Cyanide Management Code For the Manufacture, Transport, and Use of Cyanide in the Production of Gold.

The key objectives of the reclamation and closure plan include:

- Minimizing erosion damage and protect surface and ground water resources through control of water runoff;

- Establishing physical and chemical stability of the site and its facilities;
- Ensuring that all cyanide and process chemicals are safely removed from the site at closure and equipment is properly decontaminated and decommissioned,
- Properly cleaning and detoxifying all facilities and equipment used in the storage, conveyance, use and handling of cyanide and other process chemicals in accordance with international practice;
- Establishing surface soil conditions conducive to the regeneration of a stable plant community through stripping, stockpiling and reapplication of soil material and/or application of waste rock suitable as growth medium;
- Repopulating disturbed areas with a diverse self-perpetuating mix of plant species in order to establish long-term productive plant communities compatible with existing land uses; and
- Maintaining public safety by stabilizing or limiting access to landforms that could constitute a public hazard.

Current 2017 asset retirement obligation (ARO) closure costs are estimated at approximately US$112.5 million for rehabilitation activities associated with existing disturbance. The currently estimated LOM closure costs total US$137.2 million.

Mexican legislation does not require the posting of reclamation or performance bonds

20.7 Permitting

Goldcorp holds the appropriate permits under local, State and Federal laws to allow mining operations. Key permits include:

- Mining concessions;
- Environmental impact assessment;
- Land use change;
- Environmental risk;
- Waste management;
- Concession Title for Groundwater Extraction;
- Waste water discharge permit;
- Single environmental license [Licencia Ambiental Única (LAU)];
- Explosives permit;
- Accident prevention program.

Additional permits required to support mining operations are summarized in Table 20-1.

Table 20.1: Permits to Support Mining Operations

Permit Name	Details
Environmental Impact Assessment Resolution Permits	
SGPA/DGIRA/DG/2441.06	Peñasquito Mining Project, authorization granted on December 12, 2006 for 22.5 years
DFZ152-203/06/1336	Authorization to construct an Electricity Transmission Line from the main station (Ramos Arizpe Primero de Mayo) to the Peñasquito substation, 400/34.5 kV. Granted on November 23, 2006
DFZ152-203/06/1156	Authorization to build the Mazapil – Cedros Road, Airstrip and Camp Site. Granted on October 9, 2006
DFZ152-203/0071	Modifications to the previously approved Authorization to build the Mazapil – Cedros Road, Airstrip and Camp Site. Granted on January 24, 2007
SGPA/DGIRA/DG/0537.07	Peñasquito Mining Project relocation of infrastructure, authorization granted on March 9, 2007
SGPA/DGIRA/DG/0725.07	Peñasquito Mining Project 45 day extension to comply with specific conditions. Granted on April 10, 2007
DFZ152-203/07/1444	Authorization to build the Mazapil main road. Granted on December 18, 2007
SGPA/DGIRA/DG/1835/08	Large mining permit. Granted on June 12, 2008 for 23 years
DFZ152-203/08/1758	Authorization to build the Peñasquito Aerodrome. Granted on December 15, 2008
SGPA/DGIRA/DG/4860.12	Tailing pond expansion and phase II of the Leach Pad. Granted on June 26, 2012
DFZ152-203/14/0646	Modification Aerodrome project. Granted Apr 14
DFZ152-203/14/1038	Torres & Vergel Water wells field. Granted Jun 14
SGPA/DGIRA/DG/08869-14	Notification not requirement of Environmental Impact Assessment for special waste storage area included in Peñasquito expansion project. Jul 2014
SGPA/DGIRA/DG/00254	Modification Peñasquito Mining Project – South Waste rock dump expansion. January 2015
SGPA/DGIRA/DG/00436	Modification to the Tailings expansion project and Phase II Heap Leach facilities for the West-South waste rock dump expansion. January 2015
SGPA/DGIRA/DG/00435	Modification to the Peñasquito expansion project for the West-South waste rock dump expansion. January 2015
SGPA/DGIRA/DG/06600	Metallurgic Enhancement Project (MEP,) September 2015 for 20 years.
Land Use Change Permits	
DFZ152.201/06/1391	Authorization for land use change of forest surface for the construction of an electricity transmission line from the main station to the Peñasquito sub-station. Granted on December 4, 2006
DFZ152.201/06/1196	Authorization for land use change of forest surface to build the Mazapil – Cedros Road, Airstrip and Camp

Permit Name	Details
	Site. Granted on October 5, 2006
DFZ152.201/06/1400	Authorization for land use change of forest surface for the construction of the Peñasquito Mining Project, authorization granted on December 11, 2006
DFZ152.201/07/0204	Authorization for land use change of forest surface for a new design of the main road to Mazapil. Granted on February 14, 2007
DFZ152-201/07/0789	Authorization modification Heap Leach Pad, process plant and South waste rock dump, top soil storage and landfill. July 13, 2017
DFZ152.201/07/1447	Authorization for land use change of forest surface for the State Road/beltway Mazapil, Zacatecas (Libramiento Mazapil, Zacatecas). Granted on December 19, 2007
DFZ152.201/07/1449	Authorization for land use change of forest surface for the expansion of the Peñasquito project towards the area called "El Peñasco". Granted December 19, 2007
DFZ152.201/09/051	Environmental compensation for the construction of the Peñasquito aerodrome. Issued January 19, 2009
DFZ152.201/12/0602	Authorization for land use change of forest surface for the Tailing pond expansion and phase II of the Leach Pad. Granted on March 15, 2012
DFZ152-201/13/2034	Authorization for land use change of forest surface for Expansion Aerodrome. Granted Dec 11, 2013
DFZ152-201/14/1424	Authorization for land use change of forest surface for Torres and Vergel water well fields (production and monitoring wells Phase I. September 2014
DFZ152-201/15/0152	Authorization for land use change of forest surface for Torres and Vergel water well fields (production and monitoring wells Phase II. January 2015
DFZ152-201/15/0478	Authorization for land use change of forest surface for North water well field (NWF)
DFZ152-201/15/0724	Authorization for land use change of forest surface for Torres and Vergel water well fields (production and monitoring wells Phase III. April 14, 2015
DFZ152-201/15/1360	Melchor Ocampo Exploration project
DFZ152-201/15/1566	Authorization for land use change of forest surface for Metallurgic Enhancement Project (MEP)
DFZ152-201/15/1947	Heap Leach Expansion phase II and North Waste Rock
Concession Title for Groundwater Use and Extraction and Wastewater Discharge	
07ZAC120195/36FMDL08	Runs from 01-April-08 to 4-Nov-18; authorized extraction volume of 2,150,000 m^3
07ZAC120326/36FMDL08	Runs from 04-Nov-08 to 4-Nov-18; authorized extraction volume of 2,687,380 m^3
07ZAC120404/36EMDL14	Wastewater permit runs from 5-march-2009 to 14 March 2019 authorized discharge volume 81,993.60

Permit Name	Details
	m3
07ZAC100886/36FMDL09	Runs from 15-April-09 to 16-Oct-2039; authorized extraction volume of 450,000 m^3
07ZAC120616/36FMDL09	Runs from 07-Jul-09 to 03-May-2019; authorized extraction volume of 16,869,047 m^3
07ZAC121303/36FMDL11	Runs from 31-Jan-11 to 4 Feb-22; authorized extraction volume of 2,155,169 m^3
07ZAC121366/36FMDL14	Runs from 14 May 2013 to 20-Dec-2024; authorized extraction volume of 5,927,820.20 m^3
07ZAC121550/36FMDL14	Runs from 18-Aug-2014 to 26 June-24; authorized extraction volume of 1,846,747 m^3
07ZAC154026/36FMDL15	Runs from 2-Jun-2015 to 23-Oct-2025; authorized extraction volume of 9,201,217.20 m^3
Air Emissions	
DFZ152-204/09/0982	Sole Environmental License for Operation (Licencia Ambiental Única para Funcionamiento y Operación) July 2009
DFZ152- 204/13/1253	Updated Solee Environmental License July 2014
DFZ152-204/15/0591	Updated Solee Environmental License March 2015
Miscellaneous Permits	
DGGIMAR.710/007403	Mining Waste Management Plan Sep 22,2009
4243/2015	Updated Special Waste Register. Ago 2015
DGGIMAR.710/008167	Modification Mining and Metallurgic Waste Management Plan. September 2014
DGGIMAR.710/001969	Register Mining waste management plan. March 2015
DGGIMAR.710/005128	Programme for Accident Prevention High-Risk Activities - Peñasquito Programa para la Prevención de Accidentes de Actividades Altamente Riesgosas – Peñasquito July 2014
SGPA/DGVS/08376/09	Management Unit for Wildlife Conservation - Peñasquito Unidad de Manejo para la Conservación de la Vida Silvestre – Peñasquito November 2009
SGPA/DGVS/08377/09	Approval of Management Plan UMA – Peñasquito November 2009
DFZ152-201/15/0981–	Seed collection permit- Peñasquito
Licencia de Operación fuentes de radiación	Operating License radiation sources

20.8 Considerations of Social and Community Impacts

Public consultation and community assistance and development programs are ongoing.

Minera Peñasquito and Ejidos Cedros and Mazapil have established trust funds for locally-managed infrastructure, education and health projects. Minera Peñasquito provides annual funding for these trusts. The communities around the Peñasquito mine also benefit from a number of programs and services provided, or supported, by the mine. In addition, the Peñasquito mine operates a forestry nursery that produces 3.5 million trees annually. These trees are used for reforestation around the mine and within the local communities.

20.9 Comments on Section 20

The QPs note:

- The Project’s LAU is based on an approved environmental impact assessment, an environmental risk study, and a land use change authorization. The LAU also establishes the emissions requirements in terms of air, water and waste rock quality for the operations;
- Annual land usage and environmental compliance reports have been lodged;
- The appropriate environmental permits have been granted for Project operation by the relevant Mexican Federal, State and Municipal authorities;
- At the effective date of this Report, environmental liabilities are limited to those that would be expected to be associated with an operating gold mine where production occurs from open pit sources, including roads, site infrastructure, and heap leach, waste rock and disposal facilities.

21.0 CAPITAL AND OPERATING COSTS

21.1 Capital Cost Estimate

All capital expended prior to 1 January 2018 was considered as initial project capital ("sunk" capital), either spent or committed to be spent, and so was not included in the economic evaluation. Exploration expenditures were not included in the financial analysis. Exploration drilling will be performed in the future to target mineralization that may lead to an increase in Mineral Resources. Because these future exploration drilling expenditures do not pertain to the current Mineral Reserves, they were not included in the financial model.

Capital costs are based on the latest mine construction data and budgetary figures and quotes provided by suppliers. Capital cost estimates include funding for infrastructure, mobile equipment, development and permitting, and miscellaneous costs. Infrastructure requirements were incorporated into the estimates as needed. Sustaining capital costs reflect current price trends.

As with all capital projects, Board of Director approval was provided to support the Mineral Reserve and LOM plan, and PLP construction which commenced in the fourth quarter of 2016.

The sustaining and expansionary capital cost estimates are included as Table 21-1.

21.2 Operating Cost Estimates

Operating costs were estimated by Goldcorp personnel, and are based on the 2017 LOM budget. Labour cost estimation is based on Goldcorp's 2017 salary scale and fringe benefits in force. Mining consumables are based on 2017 costs and contracts and the costs for future operation consumables, such as mill reagents, grinding media, etc. are based on recent supplier quotations.

The operating cost estimate over the LOM is presented in Table 21-2 and includes allocations for processing and overhead costs.

Table 21.1: Capital Cost Estimate

Area	Life-of-Mine (US$ million)
Mine Pre-Stripping	$ 818.30
General Sustaining	$ 1,087.79
Growth	$ 191.75
Total	***$2,097.84***

Note: Totals may not sum due to rounding.

Table 21.2: Operating Cost Estimate

Area	Life-of-Mine (US$/t)
Process Plant (with Pyrite Leach)	$ 9.09/t milled
Process Plant (without Pyrite Leach)	$ 7.46/t milled
General & Administration	$ 1.88/t milled
Mining	$1.87t of material mined

21.3 Comments on Section 21

The capital cost estimates are based on a combination of quotes, vendor pricing, and Goldcorp's experience with similar-sized operations. The capital cost estimates include direct and indirect costs.

Operating costs were based on estimates from first principles for major items; the costs include allowances or estimates for minor costs.

22.0 ECONOMIC ANALYSIS

Goldcorp is using the provision for producing issuers, whereby producing issuers may exclude the information required under Item 22 for technical reports on properties currently in production and there is no material expansion of current production.

Mineral Reserve declaration is supported by a positive discounted cashflow.

22.1 Comments on Section 22

The operations demonstrate positive economics over the LOM.

23.0 ADJACENT PROPERTIES

This section is not relevant to this Report.

24.0 OTHER RELEVANT DATA AND INFORMATION

This section is not relevant to this Report.

25.0 INTERPRETATION AND CONCLUSIONS

25.1 Introduction

In the opinion of the responsible QPs, the following interpretations and conclusions are appropriate to the current status of the Project.

25.2 Mineral Tenure, Surface Rights, Agreements, and Royalties

- Information from legal experts and Goldcorp's in-house experts support that the mining tenure held is valid and sufficient to support a declaration of Mineral Resources and Mineral Reserves;
- Surface rights in the vicinity of the Chile Colorado and Peñasco open pits are held by four ejidos: Ejido Cedros, Ejido Mazapil, Ejido El Vergel and Ejido Cerro Gordo, as well as certain private owners;
- Goldcorp has agreements in place with Ejido Cedros, Ejido Mazapil, Ejido El Vergel, Ejido Cerro Gordo, and certain private owners;
- Goldcorp currently holds sufficient surface rights in the Project area to support the mining operations, including provisions for access and power lines;
- Wheaton PM is entitled to 25% of the silver produced over the LOM of the Project;
- A 2% NSR royalty is owed to Royal Gold on production from both the Chile Colorado and Peñasco locations;
- Royalties are payable to the Government of Mexico and include a 7.5% mining royalty and a 0.5% environmental erosion fee; and
- Goldcorp is not aware of any other significant environmental, social or permitting issues that would prevent continued exploitation of the Project deposits.

25.3 Geology and Mineralization

- Knowledge of the deposit settings and lithologies, as well as the structural and alteration controls on mineralization and the mineralization style and setting, is sufficient to support Mineral Resource and Mineral Reserve estimation; and
- Deposits within the Peñasquito Operations are considered to be examples of mineralization hosted by breccia pipes, and by the sedimentary rocks adjacent to them, developed as a result of intrusion-related hydrothermal activity.

25.4 Exploration, Drilling and Data Analysis

- The exploration programs completed to date are appropriate to the style of the deposits identified within the Project. The research work supports Goldcorp's genetic and affinity interpretations for the deposits;
- Sampling methods are acceptable, meet industry-standard practice, and are acceptable for Mineral Resource and Mineral Reserve estimation and mine planning purposes;
- The quality of the gold, silver, and base metals analytical data is reliable and sample preparation, analysis, and security are generally performed in accordance with exploration best practices and industry standards;
- The quantity and quality of the lithological, geotechnical, collar and down-hole survey data collected during the exploration and delineation drilling programs are sufficient to support Mineral Resource and Mineral Reserve estimation. The collected sample data adequately reflect deposit dimensions, true widths of mineralization, and the style of the deposits. Sampling is representative of the metal grades in the deposits, reflecting areas of higher and lower grades;
- The QA/QC programs adequately address issues of precision, accuracy and contamination. Drilling programs typically include blanks, duplicates and SRM samples. QA/QC submission rates meet industry-accepted standards. The QA/QC programs did not detect any material sample biases;
- The data verification programs concluded that the data collected from the Project adequately support the geological interpretations and constitute a database of sufficient quality to support the use of the data in Mineral Resource and Mineral Reserve estimation; and
- There is potential for additional deposit styles within the extensive Peñasquito Operations area, including base metal skarns and porphyry-related disseminated deposits.

25.5 Metallurgical Testwork

- Metallurgical testwork and associated analytical procedures were performed by recognized testing facilities, and the tests performed were appropriate to the type of mineralization;
- The mineralogical complexity of the Peñasquito ore makes the development of metal recovery models difficult as eight elements (gold, silver, lead, zinc, copper, iron, arsenic and antimony) are tracked through the process, and the metallurgical models need to be sufficiently robust to allow for changes in mineralogy and plant operations while giving reasonable predictions of concentrate quality and tonnage. An update to the models was

made in 2015, and in 2017 a further update was carried out to incorporate the impact of organic carbon on all ore types.

- Treatment of high-carbon materials by the pre-flotation of carbon has showed to be feasible and testing results are the basis for a plant design add-on expansion;
- Metallurgical testing in the recovery of pyrite from tailings and the subsequent recovery of gold contained in the concentrate has demonstrated to be feasible. The PLP was constructed based on positive results;
- Modelling suggests that there is some potential to have significantly lower gold and lead recoveries when processing low-lead ores on a day-to-day basis. However, over the life of the mine the impact of these materials is not considered to be a major recovery issue; and
- Deleterious elements are present in the deposit and must be accommodated in the process design. The future impact of deleterious elements is highly dependent on the lead:copper ratio in ores; organic carbon and mercury content can also be deleterious, but are currently considered to be adequately controlled.

25.6 Mineral Resource Estimation

- The Mineral Resource estimation for the Project conforms to industry practices and meets the requirements of 2014 CIM Definition Standards; and
- Factors that may affect the Mineral Resource estimates include metal prices and exchange rate assumptions, assumptions which are used in the LG shell constraining Mineral Resources, including mining, processing and G&A costs, metal recoveries, geotechnical and hydrogeological assumptions, and assumptions that the operation will maintain the social licence to operate.

25.7 Mineral Reserve Estimation

- The Mineral Reserve estimation for the Project conforms to industry practices and meets the requirements of 2014 CIM Definition Standards; and
- Factors that may affect the Mineral Reserve estimates include metal prices and exchange rate assumptions; mining, process, operating and capital cost assumptions; availability of water sufficient to support the mine design and process plant throughput rate assumptions; deleterious substances in mineralization that can affect metallurgical recovery rates; social licence to operate being maintained; and any additional modifications or proposed changes to the expected LOM taxation and royalty regime.

25.8 Mine Plan

- The proposed mine life is 12 years (2018 to 2029);
- Mining operations can be conducted year-round;
- Mining is conducted using conventional open pit truck and shovel techniques;
- A stockpiling strategy is practiced so that higher-grade ores are sent to the mill ahead of lower-grade material;
- The open pit operations will progress at a nominal annual mining rate of 200 Mt/a. until 2020, after which the rate will continue to decline as the stripping ratios of ore to waste decrease. For the milling throughput, the LOM plan assumes a nominal rate of 41 Mt/a. until the end of 2028, and the first quarter of 2029 and the heap leach pad will be stacked with incremental oxide ore as it is mined. Production forecasts are achievable with the current equipment and plant, replacements have been acceptably scheduled;
- There is some upside for the Project if the Inferred Mineral Resources that are identified within the mineral resource open pit can be upgraded to higher confidence Mineral Resource categories;
- Open pit design for the Project uses defined geotechnical domains together with rock mass quality ratings for the principal lithologies and appropriate pit design criteria that reflect expected conditions and risk. Geotechnical studies were completed by external consultants and Goldcorp operations staff;
- A combination of Goldcorp staff and external consultancies have developed the pit water management program, completed surface water studies, and estimated the life-of-mine site water balance. Management of water inflows to date have been appropriate, and no hydrological issues that could impact mining operations have been encountered; and
- As part of day-to-day operations, Goldcorp will continue to undertake reviews of the mine plan and consideration of alternatives to and variations within the plan. Alternative scenarios and reviews may be based on ongoing or future mining considerations, evaluation of different potential input factors and assumptions, and corporate directives.

25.9 Process Plan

- The Peñasquito Operations consist of a heap leach gold and silver recovery facility that can process a nominal 25,000 t/d of oxide ore and a sulphide plant that processes a nominal 124,000 t/d of sulphide ore;
- The mine uses a conventional heap leach and sulphide mineral plant recovery flowsheet to produce doré and lead and zinc concentrates respectively; and

- Plant expansion is underway by the addition of the Pyrite Leach Process and the Carbon Pre-Flotation Process.

25.10 Infrastructure Considerations

- The current built infrastructure will support the current LOM; and
- Waste rock storage capacity is suitable for the LOM production as envisaged in this Report.

25.11 Markets and Contracts

- The terms contained within the doré sales contracts are typical and consistent with standard industry practice, and are similar to contracts for the supply of doré elsewhere in the world; and
- The terms contained within the smelter contracts are typical and consistent with standard industry practice and are similar to contracts for the supply of concentrates elsewhere in the world.

25.12 Environmental, Social Issues and Permitting

- Goldcorp has sufficiently addressed the environmental impact of the operation, and subsequent closure and remediation requirements that Mineral Resources and Mineral Reserves can be declared, and that the mine plan is appropriate and achievable;
- Closure provisions are appropriately considered in the mine plan;
- Permits held by Goldcorp for the Project are sufficient to ensure that mining activities within the Project are conducted within the regulatory framework required by the Mexican Government and that Mineral Resources and Mineral Reserves can be declared;
- There is sufficient capacity for storage of the LOM tailings within the ultimate conceptual facility design, and all the required capital costs associated with facility expansion have been included in the capital and operating costs estimates;
- The mine has received permits to pump up to 40.2 Mm^3 of this water per year via eight water rights titles over the Torres and Vergel water well field and NWF. Infrastructure to source water from the NWF and the well field has been constructed providing long-term sustainable water supply for and the only water-infrastructure related expenditures will be well replacement and maintenance that will be required for the remainder of the LOM; and
- The mine is operated as a zero-discharge system. Peñasquito does not discharge process water to surface waters, and there are no direct discharges to surface waters. In

2017, the Peñasquito Operations recycled almost 77% of the water that is used in the mining process through the existing tailings facility.

25.13 Capital and Operating Cost Estimates

- The capital cost estimates are based on a combination of quotes, vendor pricing, and Goldcorp experience with similar-sized operations; and
- Capital costs for the years 2018 to 2029 total US$2,097.84 million, comprising US$818.30 million of mine pre-stripping, US$1,087.79 million of general sustaining, and US$191.75 million of expansionary capital. An average unit operating cost of US$9.09/t milled was estimated over the life-of-mine for the process plant with pyrite leach, and US$7.46/t milled for the process plant LOM if the pyrite leach circuit is excluded. G&A costs average 1.88/t milled over the LOM. The LOM average mining cost is US$1.87/t material mined.

25.14 Financial Analysis

- Using the assumptions detailed in this Report, the Peñasquito Operations have positive economics until the end of the mine life documented in the Mineral Reserves mine plan, which supports Mineral Reserve estimation.

25.15 Conclusions

- In the opinion of the responsible QP, the Peñasquito Operations that are outlined in this Report have met corporate objectives in that Mineral Resources and Mineral Reserves have been estimated, and a mine has been constructed; and
- Inferred Mineral Resources above the cut-off were treated as “waste” in this evaluation. This mineralization represents upside potential for the Peñasquito Operations if some or all of the Inferred Mineral Resources identified within the LOM production plan can be upgraded to higher-confidence mineral resource categories, and eventually to Mineral Reserves.

26.0 RECOMMENDATIONS

26.1 Exploration

The exploration drilling program focused on extending the extent of the known mineralization should be continued.

In 2018, drilling will focus on supporting estimation of Indicated Mineral Resources, delineating extensions to high-grade zones within the deposits, and defining additional mineralization that could potentially support resource estimation within the operations area. The 2019 drilling program budget is estimated at US$10.5 million; similar expenditures are anticipated for the subsequent three years.

26.2 Metallurgical Testwork

Once sufficient data from the new process modifications is available (CPP and PLP) on all ore types, efforts should be made to revisit the metallurgical recovery models in keeping with good practice. To support continued process optimization, further geometallurgical variability testing on future ores is necessary to better understand recovery and operating cost variability (approximate cost US$1.5 million).

26.3 Tailings Storage Facility

The current TSF has been designed to feasibility level and permitted to 1,908 m elevation. Concept studies were completed during 2017 that indicated that the current facility can be safely raised to 1,922 m elevation, adequate to store all LOM tonnage as indicated in June 30, 2017 Mineral Reserve statement. The engineering costs are expected to be $22M, which were included in budget. Based on the results of those studies, additional optimization to centerline raise may be done in the future in order to reduce construction costs and optimize factors of safety.

27.0 REFERENCES

Belanger, M., and Pareja, G., 2014: Peñasquito Polymetallic Operation Zacatecas State Mexico, NI 43-101 Technical Report: NI 43-101 technical report prepared for Goldcorp, effective date 8 January 2014.

Belanger, M., Pareja, G., Chen, E. and Nahan, P., 2011: Peñasquito Polymetallic Operation, Zacatecas State, Mexico, NI 43-101 Technical Report, unpublished NI 43-101 technical report prepared for Goldcorp, effective date 31 December 2011.

Bryson, R.H., Brown, F.H., Rivera, R., and Butcher, M.G., 2009: Peñasquito Project Technical Report, Concepción del Oro District, Zacatecas State, México: unpublished NI 43-101 technical report prepared for Goldcorp, effective date 10 March 2009.

Bryson, R.H., Brown, F.H., Rivera, R., and Ristorcelli, S., 2007: Peñasquito Project Technical Report, Concepción del Oro District, Zacatecas State, México: unpublished NI 43-101 technical report prepared for Goldcorp, effective date 31 December 2007.

Canadian Institute of Mining, Metallurgy and Petroleum (CIM), 2003: Estimation of Mineral Resources and Mineral Reserves, Best Practice Guidelines: Canadian Institute of Mining, Metallurgy and Petroleum, November 23, 2003, http://www.cim.org/committees/estimation2003.pdf.

Canadian Institute of Mining, Metallurgy and Petroleum (CIM), 2014: CIM Standards for Mineral Resources and Mineral Reserves, Definitions and Guidelines: Canadian Institute of Mining, Metallurgy and Petroleum.

Canadian Securities Administrators (CSA), 2011: National Instrument 43-101, Standards of Disclosure for Mineral Projects, Canadian Securities Administrators.

De Rujiter, A., Goodman, S., Pareja, G., and Redmond, D., 2015: Peñasquito Pollymetalic Operation Zacatecas State México, NI 43-101 Technical Report: NI 43-101 technical report prepared for Goldcorp, effective date 31 December 2015.

Goldcorp, 2014: Copia de PSQ - Base Case V174 - Send to Vancouver: Excel spreadsheet, December 20, 2013.

Independent Mining Consultants, 2005: Executive Summary of the Technical Report Preliminary Resource Estimate Update for the Peñasco Deposit, Peñasquito Project State of Zacatecas, Mexico: unpublished NI 43-101 technical report prepared by Independent Mining Consultants for Western Silver Corporation, April 2005.

M3 Engineering and Technology Corp., 2004: Western Silver Corporation, Peñasquito Pre-Feasibility Study: unpublished NI 43-101 technical report prepared by Independent Mining Consultants for Western Silver Corporation, April 2004; amended and restated 8 November 2004, further amended and restated 10 December 2004.

Marek, J., Hanks, J.T., Wythes, T.J., Huss, C.E., and Pegnam, M.L., 2005: Peñasquito Feasibility Study Volume I NI 43-101 Technical Report: unpublished NI 43-101 technical report prepared by M3 Engineering and Technology Corp. for Western Silver Corporation, November 2005.

Marlow, J., 2004: Technical Report, Preliminary Resource Estimate, for the Peñasco Deposit Peñasquito Project State of Zacatecas, Mexico: unpublished NI 43-101 technical report prepared for Western Silver Corporation, effective date 3 November 2004.

SNC Lavalin, 2004: Minera Penasquito, S.A. De C.V., Peñasquito Project, Mineral Resource Estimate for Chile Colorado Zone: unpublished NI 43-101 technical report prepared by SNC Lavalin for Western Silver Corporation, March 2004.

Voorhees J.S., Hanks, J.T., Drielick, T.L., Wythes, T.J., Huss, C.E., Pegnam, M.L., and Johnson, J.M., 2008: Peñasquito Feasibility Study, 100,000 Mtpd, NI 43-101 Technical Report: unpublished NI 43-101 technical report prepared by M3 Engineering and Technology Corp. for Glamis Gold Inc., effective date 31 July 2006.