



**FORTUNA**  
SILVER MINES INC.

Fortuna Silver Mines Inc.: Caylloma Property, Caylloma District, Peru

**Amended Technical Report**  
**Effective Date: August 31, 2016**  
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## **Date and Signature Page**

### **Technical Report**

**Fortuna Silver Mines Inc.: Caylloma Mine, Caylloma District, Peru**

**Effective date of this report is August 31, 2016**

### **Issued by:**

**Fortuna Silver Mines Inc.**

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[signed and sealed]

30<sup>th</sup> January 2017  
Date

Edwin Gutierrez  
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30<sup>th</sup> January 2017  
Date



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# 1 Summary

## 1.1 Introduction

This Technical Report has been prepared by Fortuna Silver Mines Inc. (Fortuna) in accordance with the disclosure requirements of Canadian National Instrument 43-101 (NI 43-101) to disclose recent technical and scientific information in respect to the Caylloma operation including:

- Exploration and infill drilling activities conducted since March 22, 2013 (effective date of previous Technical Report)
- Mineral Resources and Mineral Reserves as of December 31, 2015 taking into account all new relevant information as of June 30, 2015 and production related depletion
- Description of the upgraded plant commissioned in March 2016 allowing production to be increased to a maximum of 1,500 tpd and the related effect on the projected economic analysis

This report supersedes the previous Technical Report filed on April 15, 2013 (Chapman & Kelly, 2013).

## 1.2 Property description, location and ownership

The Caylloma Property is an operating underground mine located in the Caylloma Mining District, 225 kilometers by road north-northwest of Arequipa, Peru. The property is 14 kilometers northwest of the town of Caylloma at the UTM grid location of 8192263E, 8321387N, (WGS84, UTM Zone 19S) and covers a total of 35,022.24 hectares.

Since June 2005, the Caylloma Property has been 100 percent owned by Minera Bateas S.A.C. (Minera Bateas), a Peruvian subsidiary of Fortuna Silver Mines Inc. (Fortuna).

## 1.3 Geology and mineralization

The property is within the historical mining district of Caylloma, northwest of the Caylloma caldera complex and southwest of the Chonta caldera complex. Host rocks at the Caylloma Property are volcanic in nature, belonging to the Tacaza Group. Mineralization is in the form of low to intermediate sulfidation epithermal vein systems.

Epithermal veins at the Caylloma Property are characterized by minerals such as pyrite, sphalerite, galena, chalcopyrite, marcasite, native gold, stibnite, argentopyrite, and silver-bearing sulfosalts (tetrahedrite, polybasite, pyrargyrite, stephanite, stromeyerite, jalpite, miargyrite and bournonite). These are accompanied by gangue minerals, such as quartz, rhodonite, rhodochrosite, johannsenite (manganese-pyroxene) and calcite.

There are two different types of mineralization at Caylloma; the first is comprised of silver-rich veins with low concentrations of base metals and includes the Bateas, Bateas Techo, La Plata, Cimoide La Plata, San Cristobal, San Pedro, San Carlos, Paralela, and Ramal Paralela veins. The second type of vein is polymetallic in nature with elevated

lead, zinc, copper, silver and gold grades and includes the Animas, Animas NE, Santa Catalina, Soledad, Silvia, Pilar, Patricia, and Nancy veins.

Underground operations are presently focused on mining the Animas and Animas NE veins.

## 1.4 Exploration

Fortuna has assigned US\$2.9 million in 2016 for Brownfields exploration of the Caylloma District. This includes 17,000 meters of diamond drilling focused on testing new exploration targets in the northern portion of the Pisacca prospect area located a short distance to the southwest of the mine plant as well as further exploring the northeastern extension of the Animas vein.

## 1.5 Mineral Resources and Mineral Reserves

The 2015 Mineral Resource update has relied on channel and drill hole sample information obtained by Minera Bateas since 2005. Mineralized domains identifying potentially economically extractable material were modeled for each vein and used to code drill holes and channel samples for geostatistical analysis, block modeling and grade interpolation by ordinary kriging or inverse distance weighting.

Mineral Resource and Mineral Reserve estimates for the Caylloma Property are reported as of December 31, 2015 and detailed in Table 1.1 and Table 1.2.

**Table 1.1 Mineral Reserves as of December 31, 2015**

Category	Tonnes (000)	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Contained Metal	
						Ag (Moz)	Au (koz)
Proven	254	138	0.47	2.05	2.34	1.1	3.8
Probable	1,724	119	0.28	2.95	3.73	6.6	15.4
Proven + Probable	1,979	121	0.30	2.83	3.55	7.7	19.3

**Table 1.2 Mineral Resources as of December 31, 2015**

Category	Tonnes (000)	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Contained Metal	
						Ag (Moz)	Ag (Moz)
Measured	582	82	0.36	1.11	2.16	1.5	6.7
Indicated	1,269	84	0.31	1.14	2.10	3.4	12.7
Measured + Indicated	1,851	84	0.32	1.13	2.12	5.0	19.3
Inferred	3,392	132	0.59	2.20	3.30	14.3	64.7

Notes on next page

- Mineral Reserves and Mineral Resources are as defined by CIM Definition Standards on Mineral Resources and Mineral Reserves
- Mineral Resources are exclusive of Mineral Reserves
- Mineral Resources which are not Mineral Reserves do not have demonstrated economic viability
- The quantity and grade of the Inferred Resources reported in this estimation are conceptual in nature, and it is uncertain if further exploration will result in upgrading of Inferred Resources to Indicated or Measured Resource categories
- There are no known legal, political, environmental, or other risks that could materially affect the potential development of the Mineral Resources or Mineral Reserves



- Mineral Resources and Mineral Reserves are estimated as of June 30, 2015 and reported as of December 31, 2015 taking into account production-related depletion for the period of July 1, 2015 through December 31, 2015
- Reserves are reported above a NSR breakeven cut-off value of US\$82.73/t for Animas, US\$82.53/t for Animas NE, US\$97.07/t San Cristóbal; US\$173.74/t for Bateas, Cimoide La Plata, La Plata, and Soledad
- Mineral Resources are reported based on an NSR cut-off grade of US\$50/t for wide veins and US\$100/t for narrow veins
- Metal prices used in the NSR evaluation are US\$19/oz for silver, US\$1,140/oz for gold, US\$2,150/t for lead and US\$2,300/t for zinc
- Metallurgical recovery values used in the NSR evaluation are 84.5 % for silver, 39.5 % for gold, 92.6 % for lead, and 89.9 % for zinc with the exception of the Ramal Piso Carolina vein that uses metallurgical recovery rates of 84% for Ag and 75% for Au
- Operating costs were estimated based on actual operating costs incurred from July 2014 through June 2015
- Tonnes are rounded to the nearest thousand
- Totals may not add due to rounding

Economic values (NSR) for each mining block take into account the commercial terms of 2015, the average metallurgical recovery, the average grade in concentrate and long term projected metal prices. Mineral Reserves have been reported above a breakeven cut-off value calculated for each vein, based on NSR values and actual operating costs. Mineral Resources have been reported above a US\$50/t NSR cut-off value for veins wider than two meters and amenable to extraction by semi-mechanized mining methods (Animas, Animas NE, Nancy, and San Cristobal veins); or above a US\$100/t NSR cut-off value for veins narrower than two meters regarded as amenable to conventional mining methods (all other veins).

Mineral Resources are categorized as Measured, Indicated and Inferred. The criteria used for classification includes the number of samples, spatial distribution, distance to block centroid, kriging efficiency (KE) and slope of regression (ZZ).

Mineral Reserve estimates have considered only Measured and Indicated Mineral Resources as only these categories have sufficient geological confidence to be considered Mineral Reserves (CIM, 2014). Subject to the application of certain economic and mining-related qualifying factors, Measured Resources may become Proven Reserves and Indicated Resources may become Probable Reserves.

Fortuna believes there is good potential for an increase of the Mineral Resources at the Caylloma Property particularly from the continuity of the current veins in operation as well as from the discovery of new veins.

## 1.6 Mining operations

Minera Bateas continues to successfully manage the operation, mining 466,286 t of ore from underground to produce 1.7 Moz of silver, 1.2 koz of gold, 23.8 Mlbs of lead, and 35.8 Mlbs of zinc in 2015 while continuing to improve the mine infrastructure.

Minera Bateas continues to investigate cost effective ways to improve productivity and reduce costs. Projects include the optimization of the plant including an expansion of the lead flotation capacity so as to increase silver metallurgical recoveries by between 2 and 4 percent. Additionally, work is being conducted in 2016 to optimize the mill

capacity with the objective of increasing throughput by 10 percent to a maximum of 1,500 tpd. Minera Bateas has also launched a maintenance and energy project to reduce ongoing power costs which includes a new higher capacity electric transformer installation as well as a new transmission line from Caylloma substation to the mine.

## 1.7 Conclusions and recommendations

This Technical Report represents the most accurate interpretation of the Mineral Reserve and Mineral Resource available at the effective date of this report. The conversion of Mineral Resources to Mineral Reserves was made using industry-recognized methods, actual operational costs, capital costs, and plant performance data. Thus, it is considered to be representative of actual and future operational conditions.

The most important recommended project for the Caylloma Mine is the integration of the different levels of the Animas vein with underground ramps. An important effort in 2012 was made to improve ventilation which has allowed the operation to introduce the use of ANFO for stoping and drifting. The mine plan for 2016 includes 1,053 m of raise boring in order to comply with the ventilation requirements, 1,904 m horizontal, and 5,158 m decline drifts associated with the development of the mine especially in the case of the Animas vein. The budgeted cost of this work program in 2016 is US\$9.29 million.

The mining operation has been developed under strict compliance of norms and permits required by public institutions associated with the mining sector. Furthermore, all work follows quality and safety international norms as set out in ISO 14001 and OHSAS 18000.

Minera Bateas continues developing sustainable programs to benefit the local communities including educational, nutritional and economical programs. The socio-environmental responsibilities of these programs contribute toward establishing a good relationship between the company and local communities.

## 2 Introduction

This Technical Report has been prepared by Fortuna Silver Mines Inc. (Fortuna) in accordance with the disclosure requirements of Canadian National Instrument 43-101 (NI 43-101) to disclose recent information about the Caylloma Property. This information has resulted from additional underground development and sampling, exploration drilling, delineation drilling, upgrading of the plant to increase throughput from 1,300 tpd to a potential maximum of 1,500 tpd, and updated Mineral Resource and Reserve estimates.

Information contained within this section has been reproduced and updated where necessary from previous Technical Reports including Chapman & Kelly, 2013; Chlumsky, Armbrust, and Meyer, (CAM), 2009; CAM, 2006; and CAM, 2005.

The Caylloma Property is 100 percent owned by Fortuna (formerly Fortuna Ventures Inc.) and is located approximately 225 km by road from Arequipa in the Caylloma region of southern Peru.

Fortuna is based in Vancouver, British Columbia with management offices in Lima, Peru and is listed on the Toronto (TSX:FVI), New York (NYSE:FSM), and Frankfurt (FSE:F4S) stock exchanges.

The mineral rights of the Caylloma Property are held by Minera Bateas S.A.C. (Minera Bateas) and renewed on an annual basis. Minera Bateas is a Peruvian subsidiary 100 percent owned by Fortuna and is responsible for running the Caylloma operation. Fortuna also owns Compania Minera Cuzcatlan S.A. de C.V. which operates the San Jose silver-gold mine located in the state of Oaxaca, Mexico, as well as Minera Mansfield S.A.C. which owns the Lindero Project in Salta, Argentina.

Fortuna acquired the Caylloma Property in 2005, and placed it into production in September 2006 with a refurbished mill which included separate circuits for silver-lead, zinc, and later (in 2009) copper. The current operation exploits the Animas vein and other polymetallic (Ag-Pb-Zn) veins, in addition to the silver-gold veins previously exploited by Compania Minera Arcata, a subsidiary of Hochschild Mining plc.

The cut-off date for the drill hole and channel information used in the Mineral Resource estimate is June 30, 2015 with the Mineral Resources and Mineral Reserves reported as of December 31, 2015 with the estimates being depleted to take into account production between July and the end of 2015.

The December 31, 2015 Mineral Resource and Mineral Reserve estimates supersede the Mineral Resource and Mineral Reserve estimates reported by Fortuna (Chapman & Kelly, 2013) as of December 31, 2012.

Field data was compiled and validated by Minera Bateas and Fortuna staff. Geological description of the samples, geological interpretations and three-dimensional wireframes of the veins were completed by Minera Bateas and reviewed by Fortuna personnel. The June 2015 Mineral Resource estimates were undertaken by Fortuna under the technical supervision of the Qualified Person, Mr. Eric Chapman.

The Mineral Reserves estimate and December 2015 depletions were undertaken by the Mine Planning & Engineering department of Minera Bateas under the technical supervision of the Qualified Person, Mr. Edwin Gutierrez.

The authors of this Technical Report are Qualified Persons as defined by NI 43-101. Mr Eric Chapman has been employed as Corporate Head of Technical Services since June 2016 and prior to that as Mineral Resource Manager by Fortuna since May 2011 and has visited the property on numerous occasions, the most recent being July 29, 2016. Mr Edwin Gutierrez has been the Manager of Technical Services of Fortuna since July 2015 and has also conducted regular visits to the property.

Responsibilities for the preparation of the different sections of this Technical Report are shown in Table 2.1 with definitions of terms and acronyms detailed in Table 2.2

**Table 2.1 Author's responsibilities**

Author	Responsible for sections
Eric Chapman	1. Summary; 2. Introduction; 3. Reliance on Other Experts; 4. Property Description and Location; 5. Accessibility, Climate, Local Resources, Infrastructure and Physiography; 6. History; 7. Geological Setting and Mineralization; 8. Deposit Types; 9. Exploration; 10. Drilling; 11. Sample Preparation, Analyses and Security; 12. Data Verification; 14. Mineral Resource Estimates; 23. Adjacent Properties; 24. Other Relevant Data and Information; 25. Interpretation and Conclusions; 26. Recommendations; 27. References
Edwin Gutierrez	1. Summary; 13. Mineral Processing and Metallurgical Testing; 15. Mineral Reserve Estimates; 16. Mining Methods; 17. Recovery Methods; 18. Project Infrastructure; 19. Market Studies and Contracts; 20. Environmental Studies, Permitting and Social or Community Impact; 21. Capital and Operating Costs; 22. Economic Analysis; 24. Other Relevant Data and Information; 25. Interpretation and Conclusions; 26. Recommendations; 27. References

**Table 2.2 Acronyms**

Acronym	Description	Acronym	Description
Ag	silver	MVA	megavolt ampere
Au	gold	MW	megawatt
cfm	cubic foot per minute	NI	national instrument
cm	centimeters	NN	nearest neighbor
COG	cut-off grade	NSR	net smelter return
Cu	copper	OK	ordinary kriging
g	grams	oz	troy ounce
g/t	grams per tonne	oz/t	troy ounce per metric tonne
ha	hectares	ppm	parts per million
kg	kilograms	Pb	lead
km	kilometers	psi	pounds per square inch
kg/t	kilogram per tonne	QAQC	quality assurance/quality control
kV	kilovolts	RMR	rock mass rating
kW	kilowatts	RQD	rock quality designation
kVA	kilovolt ampere	s	second
lbs	pounds	t	metric tonne
l	Litre	t/m <sup>3</sup>	metric tonnes per cubic meter
LOM	life-of-mine	tpd	metric tonnes per day
m	meters	yd	yard
Ma	millions of years	yr	year
masl	meters above sea level	Zn	zinc
Moz	million troy ounces	\$US/t	United States dollars per tonne
Mn	manganese	\$US/g	US dollars per gram
Mt	million metric tonnes	\$US/%	US dollars per percent

### **3 Reliance on Other Experts**

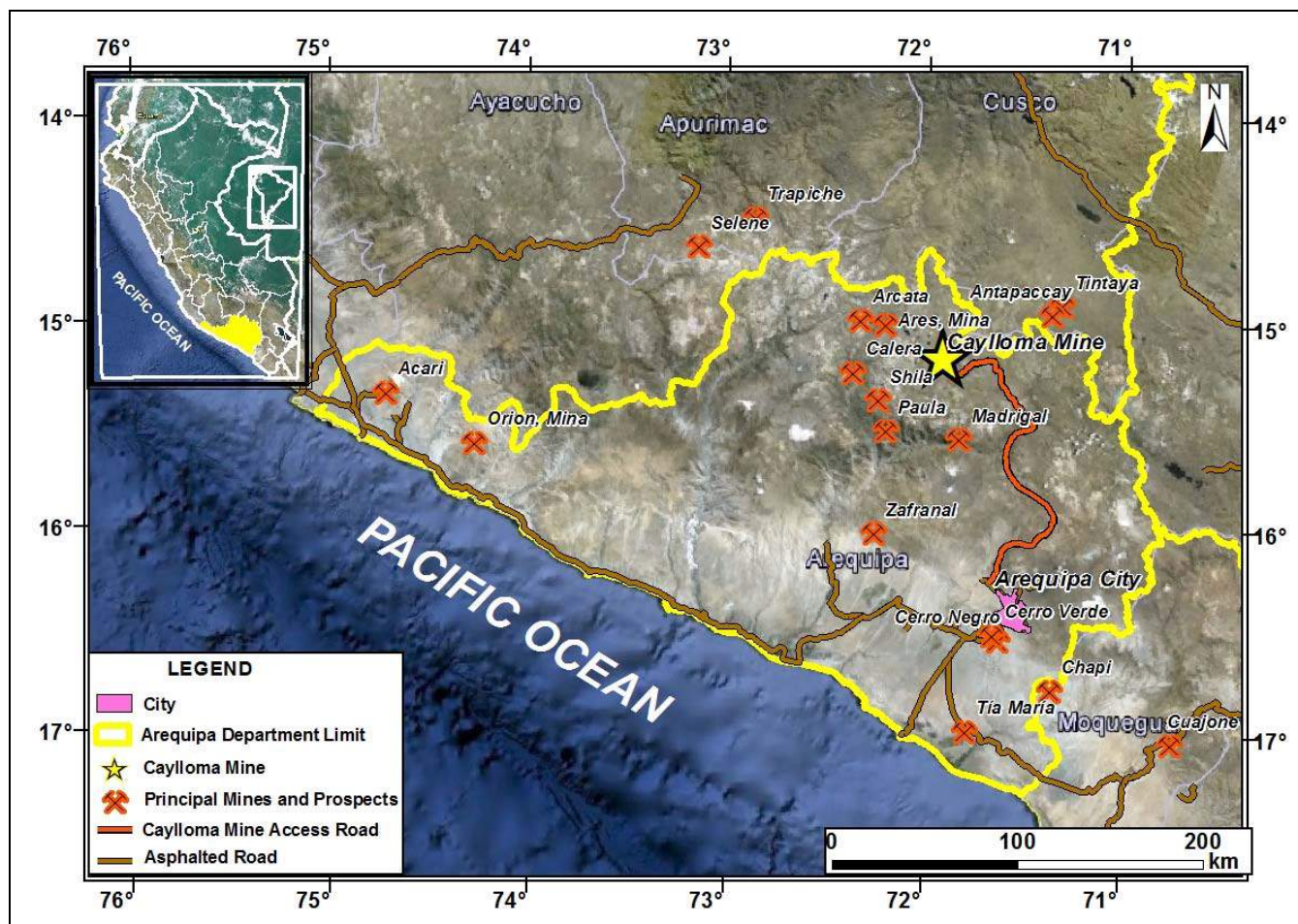
There has been no reliance on other experts who are not qualified persons in the preparation of this report except for information relating to the mineral concessions at the Caylloma Property.

Daniel Ruiz Cernades, legal counsel for Minera Bateas, reviewed and confirmed by letter dated March 8, 2016 that all mineral concessions and surface rights in the Caylloma District (as summarized in Section 4) held by Minera Bateas, a subsidiary of Fortuna, are in good standing and comply with all legal obligations required by Peruvian mining laws and regulations.

## 4 Property Description and Location

The Caylloma Silver-Lead-Zinc mine is located in the Caylloma Mining District, 225 road-kilometers north-northwest of Arequipa, Peru. The property is 14 kilometers northwest of the town of Caylloma at the UTM grid location of 8192263E, 8321387N, (WGS84, UTM Zone 19S) and covers a total of 35,022.24 hectares. The location of the mine is shown in Figure 4.1.

**Figure 4.1 Map showing the location of the Caylloma Mine**



### 4.1 Mineral tenure

Fortuna Silver Mines Inc. acquired a 100 percent interest in the Caylloma Property in June of 2005. The property comprises mining concessions (Table 4.1 and Figure 4.2); surface rights (Table 4.2); a permitted flotation plant; connection to the national electric power grid; permits for camp facilities for 890 men as well as the infrastructure necessary to sustain mining operations.

#### 4.1.1 Mining claims and concessions

The Caylloma Property consists of mineral rights for 75 mining concessions for a total surface area of 35,022 ha. A list of the mining concessions showing the names, areas in



hectares, and title details are presented in Table 4.1. In addition to these, the Huayllacho mill-site (processing plant) concession is titled, and comprises 91.12 ha, increased from 73.63 ha in July 2015 via resolution RD No 0750-2015-MEM/DGM granted by the Ministry of Energy and Mines.

In Peru, mining concessions do not have expiration dates but an annual fee must be paid to retain the concessions in good standing. Minera Bateas states that all fees are up to date and the concessions listed in Table 4.1 are all in good standing.

**Table 4.1 Mineral concessions owned by Minera Bateas**

No.	Concession Name	Area (ha)	Title details	Minera Bateas Acquisition Date
1	Acumulacion Cailloma No. 1	989.53	20005129 AREQUIPA	01/06/2005
2	Acumulacion Cailloma No. 2	920.41	20001891 AREQUIPA	01/06/2005
3	Acumulacion Cailloma No. 3	979.28	20001892 AREQUIPA	01/06/2005
4	Corona de Antimonio N.2	84.00	2025645 LIMA	01/06/2005
5	Cailloma 1	5.18	20005170 AREQUIPA	01/06/2005
6	Cailloma 2	108.67	20005171 AREQUIPA	01/06/2005
7	Cailloma 4	788.77	11020415 AREQUIPA	01/06/2005
8	Cailloma 5	514.19	11020416 AREQUIPA	01/06/2005
9	Cailloma 6	678.88	11020417 AREQUIPA	01/06/2005
10	Cailloma 7	223.04	11020419 AREQUIPA	01/06/2005
11	Cailloma 8	2.28	11020413 AREQUIPA	01/06/2005
12	Cailloma 9	0.07	11026023 AREQUIPA	01/06/2005
13	Eureka 88	4.46	20004520 AREQUIPA	01/06/2005
14	Sandra No. 37	149.14	2025648 LIMA	01/06/2005
15	Sandra No. 14	1.00	2025654 LIMA	01/06/2005
16	Sandra No. 4	28.00	2025650 LIMA	01/06/2005
17	Sandra No. 5	6.00	2025651 LIMA	01/06/2005
18	Sandra No. 6	4.00	2025652 LIMA	01/06/2005
19	Sandra No. 7	2.00	2025642 LIMA	01/06/2005
20	Sandra No. 9	9.00	2025653 LIMA	01/06/2005
21	Sandra No. 102-A	124.99	20004673 AREQUIPA	01/06/2005
22	Sandra 106	724.00	20001071 AREQUIPA	01/06/2005
23	Sandra 107	794.00	20001072 AREQUIPA	01/06/2005
24	Sandra 108	614.00	20001073 AREQUIPA	01/06/2005
25	Sandra 120	4.00	20001211 AREQUIPA	01/06/2005
26	Sandra 121	4.00	20001212 AREQUIPA	01/06/2005
27	Sandra 123	90.00	20004461 AREQUIPA	01/06/2005
28	Sandra 124	32.00	20001241 AREQUIPA	01/06/2005
29	S.P. No.16	0.12	2002858 LIMA	01/06/2005
30	Cristobal R1	300.00	11172025 AREQUIPA	30/12/2009
31	Sandra 106-A	276.00	11172022 AREQUIPA	02/06/2010
32	Sandra 107-A	206.00	11172024 AREQUIPA	11/03/2010
33	Sandra 108-A	386.00	11171025 AREQUIPA	17/05/2010
34	Sandra 108-B	3.58	11272178 AREQUIPA	28/03/2014
35	Sandra 108-C	9.25	11272012 AREQUIPA	28/03/2014
36	Cailloma 11	96.35	11199656 AREQUIPA	18/08/2011
37	Cailloma 12	100.00	11199657 AREQUIPA	18/08/2011
38	Cailloma 14	282.27	11199757 AREQUIPA	18/08/2011
39	Cailloma 15	371.31	11199759 AREQUIPA	18/08/2011
40	Cailloma 16	954.08	11199763 AREQUIPA	18/08/2011
41	Cailloma 17	337.26	11199770 AREQUIPA	18/08/2011





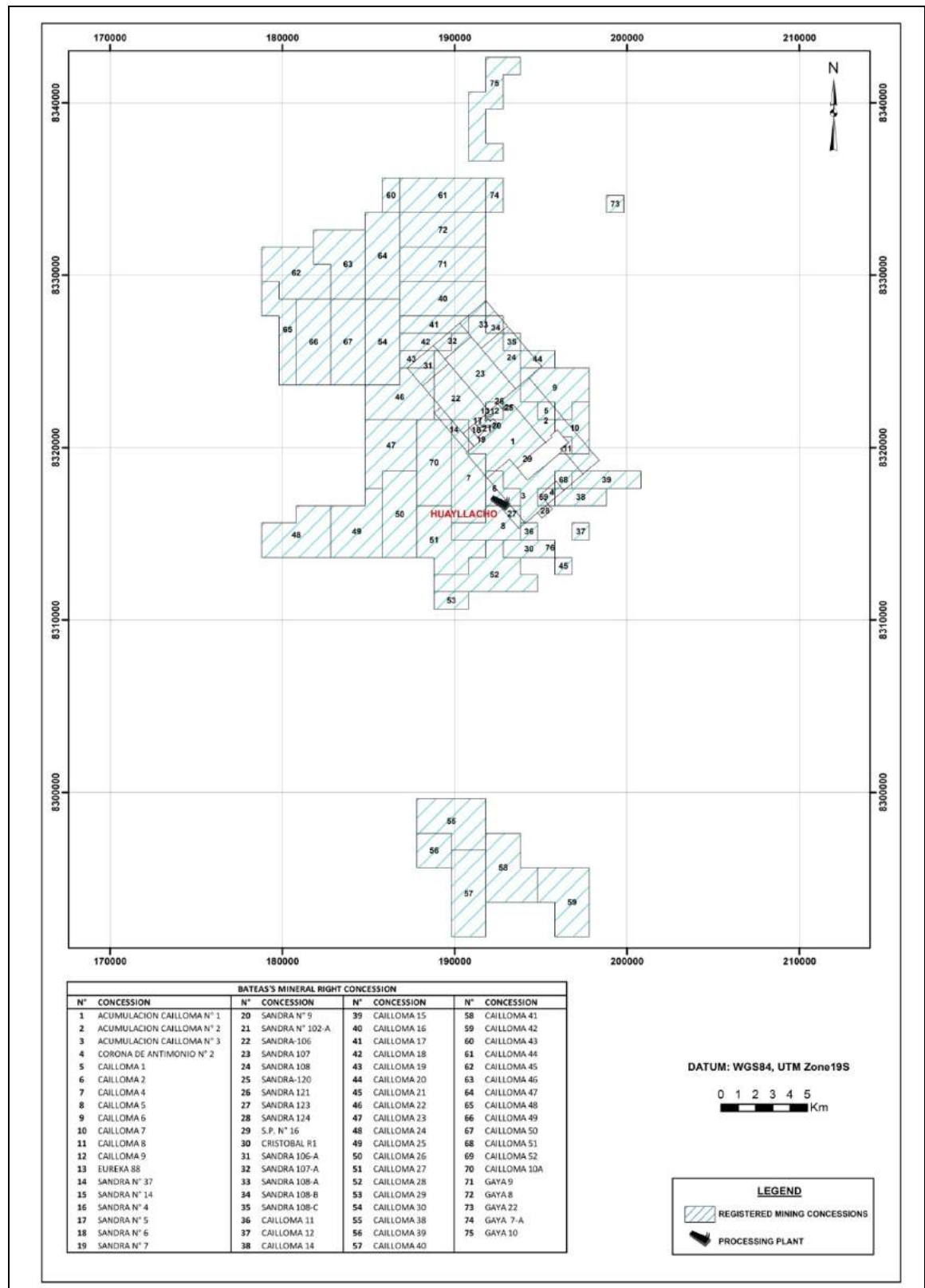
No.	Concession Name	Area (ha)	Title details	Minera Bateas Acquisition Date
42	Cailloma 18	219.65	11199774 AREQUIPA	18/08/2011
43	Cailloma 19	102.04	11199775 AREQUIPA	18/08/2011
44	Cailloma 20	112.69	11199776 AREQUIPA	18/08/2011
45	Cailloma 21	100.00	11199777 AREQUIPA	23/08/2011
46	Cailloma 22	854.75	11228688 AREQUIPA	31/05/2012
47	Cailloma 23	1,000.00	11220908 AREQUIPA	22/06/2012
48	Cailloma 24	1,000.00	11228690 AREQUIPA	23/07/2012
49	Cailloma 25	1,000.00	11228529 AREQUIPA	23/07/2012
50	Cailloma 26	1,000.00	11245343 AREQUIPA	01/03/2013
51	Cailloma 27	1,000.00	11228600 AREQUIPA	23/07/2012
52	Cailloma 28	1,000.00	11228543 AREQUIPA	23/07/2012
53	Cailloma 29	200.00	11228534 AREQUIPA	23/07/2012
54	Cailloma 30	1,000.00	11220907 AREQUIPA	11/06/2012
55	Cailloma 38	1,000.00	11220647 AREQUIPA	11/06/2012
56	Cailloma 39	400.00	11220680 AREQUIPA	11/06/2012
57	Cailloma 40	1,000.00	11220675 AREQUIPA	11/06/2012
58	Cailloma 41	1,000.00	11220679 AREQUIPA	11/06/2012
59	Cailloma 42	1,000.00	11220668 AREQUIPA	11/06/2012
60	Cailloma 43	200.00	11228686 AREQUIPA	23/07/2012
61	Cailloma 44	1,000.00	11228505 AREQUIPA	23/07/2012
62	Cailloma 45	1,000.00	11220650 AREQUIPA	11/06/2012
63	Cailloma 46	1,000.00	11220649 AREQUIPA	11/06/2012
64	Cailloma 47	1,000.00	11220648 AREQUIPA	11/06/2012
65	Cailloma 48	700.00	11228515 AREQUIPA	23/07/2012
66	Cailloma 49	1,000.00	11228549 AREQUIPA	23/07/2012
67	Cailloma 50	1,000.00	11228685 AREQUIPA	23/07/2012
68	Cailloma 51	5.35	11268988 AREQUIPA	13/02/2014
69	Cailloma 52	10.66	11272079 AREQUIPA	28/03/2014
70	Cailloma 10A	973.03	11255438 AREQUIPA	24/09/2013
71	Gaya 9	1,000.00	11191791 AREQUIPA	24/09/2013
72	Gaya 8	1,000.00	11191790 AREQUIPA	24/09/2013
73	Gaya 22	27.14	11139459 AREQUIPA	24/09/2013
74	Gaya 7-A	55.39	11191789 AREQUIPA	24/09/2013
75	Gaya 10	854.45	11257703 AREQUIPA	24/09/2013
<b>Total</b>		<b>35,022.24</b>		

It should be noted that concessions Cailloma 38 through Cailloma 42 are subject to an earn-in agreement by Minera Buenaventura. There are no known Mineral Resources or Mineral Reserves located in these concessions as of the effective date of this report.





**Figure 4.2 Location of mining concessions at the Caylloma Property**





## 4.2 Surface rights

Surface rights and easements held by Minera Bateas at Caylloma are detailed in Table 4.2.

**Table 4.2 Surface rights held by Minera Bateas at Caylloma**

No.	Name	Owner	Area (ha)	Type
1	Animas	Minera Bateas	214.41	Surface Right
2	Michihuasi Toldoña Cancha	Saturnino Llacma Cayllahue	192.45	Easement Right
3	Veta Animas Plata Way	Jose Lllallacachi and others	14.74	Easement Right
4	San Francisco I & II	Minera Bateas	61.41	Surface Right
5	Plata	Directorate General of the Agrarian Reform	255.63	Surface Right
6	Tayayaque Trinidad	Minera Bateas	441.00	Surface Right
7	Bahia Electrica Putusi Chico	Minera Bateas	0.13	Surface Right
8	Huaraco Vilafro Sahuafñaña	Domingo Lllallacachi and others	1,091.85	Easement Right
9	Huayllacho	Minera Bateas	186.73	Surface Right
10	Jururuni Vilafro	Toribio Ynfa Llacho	258.89	Easement Right
11	Jururuni Vilafro	Rodolfo Ynfa Hilasaca and others	1,047.49	Easement Right
11	Cuchuquipa (Tailings)	Lorenzo Supo Lllallacachi	17.49	Easement Right
12	Cuchuquipa	Lorenzo Supo Lllallacachi	0.40	Easement Right
13	Palcacucho	Head Office of Agrarian Reform	1.48	Easement Right
14	Anchacca	Hereditary succession Escarza Murguia	0.44	Easement Right
15	Pulimayo	Francisco Miranda Lllallacachi and others	495.65	Easement Right
16	Pisacca	Juana Anastacia Huamani Ancco and others	1,226.00	Easement Right

Regarding the current situation of the surface rights it is important to note the following:

- Peruvian legislation considers mining concessions as a right separate from the surface land where it is located.
- According to Peruvian Mining Law, a mining concessionaire requires a previous authorization from the surface owner or possessor of the land to undertake mining activities. The majority of the surface right agreements detailed in Table 4.2 are not registered and were signed by landholders (owners or possessors) that may or may not have legal titles. The agreements signed by Minera Bateas have all been formalized through Public Deeds that to the best of Minera Bateas's knowledge provide sufficient rights to operate.

## 4.3 Royalties

The Caylloma Property is not subject to any royalties, back-in rights, payments or encumbrances with the exception of the following:

- The purchase agreement of Minera Bateas, dated 6<sup>th</sup> May 2005, includes the following royalty contract term *"Minera Bateas S.A.C. grants Minera Arcata S.S. a royalty of 2.0 % of the Net Smelter Return which will apply after not less than a total of 21 million ounces of silver have been recovered from the Huayllacho beneficio (mill site) concession right. This contract is a permanent condition and will remain in total validity as long as a valid mining concession exists."*

As of June 30, 2016 Minera Bateas has produced a total of 15.6 million troy ounces of silver; therefore, this royalty condition has not yet been met.

- On October 11, 2011 Minera Focus transferred a 1 percent Net Smelter Return Royalty to Minera Bateas for the mining concessions of Deus 10 and Deus 12.

These concessions were transferred to Fresnillo Peru S.A.C. on May 18, 2012 with Minera Bateas continuing to hold the royalty.

- In accordance with the Mining Royalty Act approved by Peruvian Law No. 28258 and its corresponding regulations, federal royalties are determined by applying the monthly rates of 1 percent, 2 percent or 3 percent (scales are provided by the Regulations of the Act) on revenues net of a transport deduction. Importantly, the amount paid in royalties and mining costs can be deducted as expenses for purposes of calculating income tax. Government royalty payments are set at a base rate of 1 percent up to US\$60 million, 2 percent on the excess of US\$60 million and up to US\$120 million, and 3 percent on the excess of US\$120 million. Fortuna is on the scales of 1 percent and 2 percent and is current on payment of royalties. The application of the Mining Royalty Act mentioned above is guaranteed by the company's Legal Stability Agreement signed with the Peruvian government.

Additionally, and in accordance with Mining Special Royalty Act approved by Peruvian Law No. 29790 in 2011, royalties are determined by applying quarterly rates ranging from 4 percent to 12 percent (scales provided by the Regulations of the Act) on operating income. Any royalties due resulting from the application of this new act are only paid in excess of royalties already paid under the original Mining Royalty Act.

#### 4.4 Environmental aspects

Minera Bateas is in compliance with Environmental Regulations and Standards set in Peruvian Law and has complied with all laws, regulations, norms and standards at every stage of operation of the mine.

The Caylloma operation (legally referred to as the Economic Management Unit of San Cristobal) has fulfilled its Program for Environmental Compliance and Management (PAMA) requirements, as approved by the Directorial Resolution No. RD 087-97-EM/DGM dated June 3, 1997 as set out by the Ministry of Mines.

The PAMA identified a number of programs to complete in order for the operation to conform to regulations and standards. The main projects outlined in the PAMA program were: the construction of a retaining wall at the base of the old tailings, vegetation of the old tailings, building a retaining wall at the base of the active tailings and monitoring and treatment of mine water. The budgeted cost of the program was US\$365,000.

In 2002 the Ministry of Energy and Mines (MEM) through the Mining Inspection Department conducted an audit of the programs specified in the PAMA document and approved on November 8, 2002 with a formal resolution 309-2002-EM/DGM RD.

On September 6, 2006 the Ministry of Energy and Mines approved the restart of operations and the Huayllacho processing plant via Directorial Resolution No. 1078-2006 R MEM/DGM/V.

The regulations required the approval of the mine closure plan, at a conceptual level, which was approved by WSF Directorial Resolution No. 328-207 MEM / AAM dated December 10, 2007 by the Ministry of Mines.

The mine closure plan was approved by Executive Resolution No. 365-2009-MEM/AAM dated November 13, 2009 with an upgrade to the closure plan being

approved by Resolution No. 085-2013-MEM-AAM on March 22, 2013. An additional modification to the closure plan was requested by Minera Bateas on August 16, 2015 and approved by Resolution No. 327-2015-MEM/AAM.

On September 2, 2013 a modification to the Environmental Impact Study "*Expansion of Mine and processing plant Huayllacho, project primary electric line SE Caylloma-Bateas 15kv*" was approved by Resolution No. 459-2013-MEM/AAM.

The Sanitary Authorization for Treatment System Water was approved with Directorial Resolution No. 2307-2009/DIGESA/SA on May 18, 2009. Minera Bateas was also granted an updated license to use water to cover the demands of the operation by the National Water Authority (ANA) by Directorial Resolution No. 0048-2015 – AAA.XI-PA on April 8, 2015.

An Environmental Impact Assessment (EIA) for the "*Expansion of Mine and processing plant Huayllacho to 1,500 tpd from 1,030 tpd*" was approved with Directorial Resolution 173-2011-MEM/AAM dated June 8, 2011.

Through Resolution No. 351-2010-MEM-DGM/V authorization of the disposal of tailings in Tailings Deposit No. 2 Huayllacho has been confirmed. On January 13, 2014 Resolution No. 0015-2014-MEM-DGM/V approved the operating license for Tailings No. 2 south-side from elevation 4470 to 4474 m, pending the construction and operation of the north-side of the reservoir. Resolution No. 492-3014-MEM-DGAAM granted on September 30, 2014 then approved modification to the point monitoring program of the water at Tailings No. 3 of the UEA San Cristobal. Additionally, the Ministry of Energy and Mines approved the operating license of Deposit Tailings No. 3 – stage 1B (San Francisco Tailings) increasing the tailings height to 4,415 m by Resolution No. 0216-2014-MEM-DGM\_V on June 15, 2014.

Minera Bateas closed 25 mining environmental liabilities located within the mining concessions as part of their voluntary remediation work on December 1, 2012 via Resolution No. 588-2014-MEM-DGAAM.

## 4.5 Permits

To the extent known, all permits that are required by Peruvian law for the mining operation have been obtained.

## **5 Accessibility, Climate, Local Resources, Infrastructure and Physiography**

### **5.1 Access**

Access to the Caylloma Property is by a combination of sealed and gravel road. The property is located 225 road kilometers from Arequipa and requires a trip of approximately 5 hours by vehicle.

### **5.2 Climate**

The climate in the area is characteristic of the puna, with rain and snow between December and March, followed by a dry season from April through September. The climate allows for year-round mining and processing, although surface exploration can be disrupted between December and March due to electrical storms, snow or heavy rainfall.

### **5.3 Topography, elevation and vegetation**

The Caylloma Property is located in the puna region of Peru at an altitude of between 4,300 masl (meters above sea level) and 5,000 masl. Surface topography is generally steep. The mine facilities are located at approximately 4,300 masl.

### **5.4 Infrastructure**

The mine has been in operation intermittently for over 400 years. In 2011 and 2012 a number of new buildings were constructed to replace aging infrastructure. Newly constructed facilities included a laboratory, offices, mess hall, core logging and core storage warehouses.

Experienced underground miners live in the nearby town of Caylloma and other local towns in the district and are transported to the property by bus.

The camp and process facilities are located on the relatively flat valley floor while the entrance to the underground operations is via portals in the steep valley sides. Transport of ore is by a combination of rail, rubber-tired scoops and ore haulage trucks.

Sufficient water for the process plant and mining operations is available from the Santiago River that crosses the property.

The mine facilities are connected to the Electro Sur del Perú electric system, which supplies sufficient power for the operation.

More detailed information regarding the property infrastructure is provided in Section 18.

## 6 History

Information contained within this section has been reproduced from the Chapman and Kelly (2013) Technical Report and updated where necessary.

### 6.1 Ownership history

The earliest documented mining activity in the Caylloma District dates back to that of Spanish miners in 1620. English miners carried out activities in the late 1800s and early 1900s. Numerous companies have been involved in mining the district of Caylloma but limited records are available to detail these activities.

The Caylloma Property was acquired by Compania Minera Arcata, S.A. (CMA), a wholly owned subsidiary of Hochschild Mining plc in 1981. Fortuna acquired the property from CMA in 2005.

### 6.2 Exploration history and evaluation

CMA focused exploration on identifying high-grade silver vein structures. Exploration was concentrated in the northern portion of the district and focused on investigating the potential of numerous veins including Bateas, El Toro, Paralel, San Pedro, San Cristobal, San Carlos, Don Luis, La Plata, Apostles, and Trinidad.

Extensive exploration and development were conducted on the Bateas vein due to its high silver content; however, exploration did not extend to the northeast due to the identification of a fault structure that was thought to truncate the mineralized vein.

Animas was one of the first vein structures identified by CMA, however the mineralization style was identified as polymetallic in nature, rather than the high-grade silver veins CMA were hoping to exploit. Subsequently no further exploration or development was undertaken of this vein until Fortuna took ownership in 2005.

Table 6.1 details the drilling and channel information produced by CMA that was validated by Minera Bateas.

**Table 6.1 Exploration by drill hole and channels conducted by CMA**

Vein	Drill Holes	Channels
Paralela	-	623
San Pedro	8	2,006
San Cristóbal	20	3,833
San Carlos	-	295
Don Luis	1	-
Don Luis 1	2	-
Elisa	2	-
La Plata	9	-
Ramal San Pedro	1	-
San Miguel	2	-
Ursula	2	-



### 6.3 Historical resources and reserves

Prior to Fortuna's ownership of the property, Mineral Reserves and Mineral Resources were estimated by CMA on behalf of Hochschild Mining plc. The most recent estimate prior to Fortuna's purchase of the property was conducted in June 2004 (CMA, 2004).

Mineral Reserves and Mineral Resources estimated by CMA in June 2004 were not prepared in accordance with NI 43-101 and should not be relied upon. CMA classified resources using two criteria: the commonly accepted method based on the degree of confidence in the resource (Measured, Indicated, and Inferred); and a method based on economic criteria (NSR). The NSR value used for each metal for reporting Mineral Reserves and Mineral Resources was US\$0.13/g for silver, and US\$9.2/g for gold.

Mineral Reserves were reported above a breakeven NSR cut-off grade of US\$40.26/t (Table 6.2). Measured and Indicated Resources were subdivided into those that had an estimated NSR value between US\$28.79/t and US\$40.26/t, regarded as "marginal" (Table 6.3) and those that had an estimated NSR value less than US\$28.79/t, where Measured and Indicated Resources were combined and regarded as "sub-marginal" (Table 6.4).

**Table 6.2 Mineral Reserves reported by CMA in June 2004**

Vein Type	Category	Vein	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Contained Ag oz
Silver	Proven	San Cristóbal	106,117	505	0.40	0.02	0.02	1,722,929
		San Pedro	48,741	452	1.12	0.00	0.00	708,311
		San Carlos	3,304	1,014	0.34	0.46	1.17	107,713
		La Plata	6,839	597	2.62	0.20	0.09	131,268
		Cimoide (La Plata)	28,037	629	3.73	0.02	0.06	566,987
		Paralela	9,971	665	0.16	0.02	0.03	213,182
		TOTAL	203,008	529	1.10	0.03	0.04	3,452,708
	Probable	San Cristóbal	32,222	566	0.47	0.25	0.31	586,354
		San Pedro	29,604	387	0.98	0.04	0.07	368,343
		San Carlos	6,248	831	0.15	0.33	0.82	166,930
		La Plata	1,448	971	5.49	0.09	0.10	45,204
		Cimoide (La Plata)	4,436	532	3.83	0.06	0.11	75,874
		Paralela	4,013	770	0.00	0.09	0.17	99,346
		TOTAL	77,971	535	0.90	0.15	0.24	1,341,152
Proven + Probable			280,979	531	1.04	0.06	0.10	4,796,887

**Table 6.3 Measured and Indicated Resources (Marginal - NSR value between US\$28.79/t and US\$40.26/t) reported by CMA in June 2004**

Vein Type	Category	Vein	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Contained Ag oz
Silver	Measured	San Cristóbal	46,320	270	0.00	0.00	0.00	402,090
		San Pedro	5,322	283	0.08	0.02	0.08	48,423
		San Carlos	1,127	247	0.00	0.00	0.00	8,950
		La Plata	0	-	-	-	-	-
		Cimoide (La Plata)	0	-	-	-	-	-
		Paralela	9,307	292	0.00	0.00	0.00	87,374
		Ramal Paralela	0	-	-	-	-	-
		<b>TOTAL</b>	<b>62,076</b>	<b>274</b>	<b>0.01</b>	<b>0.00</b>	<b>0.01</b>	<b>546,846</b>
	Indicated	<b>TOTAL</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>



**Table 6.4 Measured & Indicated Resources (Sub-marginal - NSR value less than US\$28.79/t) reported by CMA in June 2004**

Vein Type	Category	Vein	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Contained Ag oz
Silver	Measured + Indicated	San Cristóbal	325,317	112	0.04	0.00	0.00	1,171,429
		San Pedro	57,683	124	0.03	0.00	0.00	229,964
		San Carlos	21,185	107	0.00	0.00	0.01	72,879
		La Plata	2,075	110	0.28	0.09	0.26	7,338
		Cimoide (La Plata)	7,493	120	0.14	0.00	0.00	28,909
		Paralela	8,099	213	0.00	0.00	0.00	55,463
		Ramal Paralela	0	-	-	-	-	-
		<b>TOTAL</b>	<b>421,852</b>	<b>115</b>	<b>0.04</b>	<b>0.00</b>	<b>0.00</b>	<b>1,559,729</b>

Additional to the Mineral Resources detailed above, CMA also reported combined Indicated and Inferred Resources above a breakeven NSR cut-off grade of US\$40.26/t (Table 6.5).

It should be noted that CMA silver grades were originally reported in troy ounces per tonne but for the purposes of this Technical Report have been converted to grams per tonne for comparison purposes.

**Table 6.5 Indicated and Inferred Resources (NSR greater than US\$40.26/t) reported by CMA in June 2004**

Vein Type	Category	Vein	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Contained Ag oz
Silver	Indicated + Inferred	San Cristóbal	127,815	439	0.22	0.33	0.42	1,804,004
		San Pedro	132,252	361	0.12	0.51	1.16	1,534,972
		San Carlos	11,956	1,066	0.31	0.64	1.63	409,764
		La Plata	34,910	770	2.88	0.18	0.81	864,235
		Cimoide (La Plata)	5,333	311	2.75	0.06	0.09	53,324
		Paralela	78,863	458	0.01	0.13	0.24	1,161,261
		Ramal Paralela	63,818	511	0.10	0.36	0.98	1,048,468
		<b>TOTAL</b>	<b>454,948</b>	<b>470</b>	<b>0.37</b>	<b>0.34</b>	<b>0.74</b>	<b>6,874,651</b>

Since Minera Bateas took ownership of the property, three independent NI 43-101 Technical Reports have been published reporting Mineral Resources and Mineral Reserves (CAM, 2005; CAM, 2006; and CAM 2009).

Mineral Resources and Reserves reported in the CAM 2005 Technical Report are based on the estimates prepared by CMA as of June 30, 2004 and adjusted by Fortuna to account for additional mining dilution and recovery.

Mineral Reserves were reported above a breakeven NSR cut-off grade of US\$40.26/t (Table 6.6).

Metal prices used in the evaluation were US\$5.87/oz for silver, US\$391.99/oz for gold, US\$896/t for lead, US\$1,010.70/t for zinc, and US\$2,685.16/t for copper. The NSR value for each metal used for reporting silver veins was US\$0.13/g for silver, US\$9.2/g for gold, whereas the NSR values used for reporting the Animas polymetallic vein was US\$0.11/g for silver, US\$1.22/g for gold, US\$5.59/% for lead, and US\$5.20/% for zinc.





**Table 6.6 Mineral Reserves reported by CAM in April 2005**

Vein Type	Category	Vein	Tonnes	Ag (g/t)*	Au (g/t)	Pb (%)	Zn (%)	Contained Ag oz
Silver	Proven	San Cristóbal	116,729	455	0.36	0.02	0.02	1,707,581
		San Pedro	53,615	407	1.01	0.00	0.00	701,571
		San Carlos	4,295	710	0.24	0.32	0.82	98,042
		La Plata	8,891	418	1.83	0.14	0.06	119,486
		Cimoide (La Plata)	36,448	440	2.37	0.01	0.04	515,605
		Paralela	10,968	599	0.14	0.02	0.03	211,225
		TOTAL	230,946	452	0.87	0.02	0.04	3,355,645
	Probable	San Cristóbal	35,444	509	0.42	0.23	0.28	580,031
		San Pedro	32,564	348	0.88	0.04	0.06	364,341
		San Carlos	8,122	582	0.11	0.23	0.57	151,977
		La Plata	1,882	680	3.84	0.06	0.07	41,145
		Cimoide (La Plata)	5,766	372	2.37	0.04	0.08	68,962
		Paralela	4,414	693	0.00	0.08	0.15	98,346
		TOTAL	88,192	461	0.74	0.14	0.20	1,306,124
	Proven + Probable		319,138	454	0.84	0.06	0.08	4,659,415
Polymetallic	Proven	Animas	316,418	172	0.35	3.01	4.86	1,752,956
	Probable	Animas	140,794	160	0.37	3.18	4.94	726,497
	Proven + Probable		457,212	169	0.35	3.06	4.88	2,482,661
Total Mineable Reserves			776,350	286	0.55	1.83	2.91	7,142,420
*Silver was originally reported in oz/t but has been converted to g/t for comparison purposes.								

\*Silver was originally reported in oz/t but has been converted to g/t for comparison purposes.

CAM was unable to confirm the Indicated and Inferred Resources reported by CMA and therefore combined both and reported as Inferred Resources (Table 6.7).

**Table 6.7 Inferred Resources reported by CAM in April 2005**

Vein Type	Vein	Tonnes	Ag (g/t)*	Au (g/t)	Pb (%)	Zn (%)	Contained Ag oz
Silver	San Cristóbal	127,815	439	0.22	0.33	0.42	1,804,004
	San Pedro	132,252	361	0.12	0.51	1.16	1,534,972
	San Carlos	11,956	1,066	0.31	0.64	1.63	409,764
	La Plata	34,910	770	2.88	0.18	0.81	864,235
	Cimoide (La Plata)	5,333	311	3.00	0.00	0.00	53,324
	Paralela	78,863	458	0.00	0.00	0.00	1,161,261
	Ramal Paralela	63,818	511	0.10	0.36	0.98	1,048,468
	<b>TOTAL</b>	<b>454,947</b>	<b>470</b>	<b>0.38</b>	<b>0.32</b>	<b>0.70</b>	<b>6,878,799</b>
Polymetallic	Animas	691,652	330	0.61	3.62	5.49	7,338,428
<b>Total Inferred Resources</b>		<b>1,146,599</b>	<b>386</b>	<b>0.52</b>	<b>2.31</b>	<b>3.59</b>	<b>14,217,828</b>

\*Silver was originally reported in oz/t but has been converted to g/t for comparison purposes.

Mineral Resources and Reserves reported in the CAM 2006 Technical Report were also based on the estimates prepared by CMA as of June 30, 2004 and adjusted by Fortuna to account for the new Animas vein model, changes in prices and costs, adjustments in mining dilution and recovery.

Mineral Reserves were reported above a breakeven NSR cut-off grade of US\$48/t (Table 6.8). Mineral Resources were reported above a NSR cut-off grade of US\$36.50/t (Table 6.9).

Metal prices used in the evaluation were US\$8/oz for Ag, US\$500/oz for gold, US\$800/t for lead, and US\$1,803/t for zinc. The NSR value for each metal used for

reporting purposes was US\$0.19/g for silver, US\$7.22/g for gold, US\$4.81/% for lead, and US\$7.10/% for zinc.

**Table 6.8 Mineral Reserves reported by CAM in October 2006**

Category	Vein	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Contained Ag oz
<b>Proven</b>	San Cristóbal	145,851	422	0.30	0.00	0.00	1,980,562
	San Pedro	52,102	407	1.00	0.00	0.00	682,646
	San Carlos	5,392	622	0.20	0.30	0.70	107,751
	La Plata	8,537	478	2.10	0.20	0.10	131,184
	Cimoide (La Plata)	30,269	575	3.40	0.00	0.10	560,075
	Paralela	11,200	592	0.10	0.00	0.00	213,294
	<b>TOTAL</b>	<b>253,351</b>	<b>451</b>	<b>0.90</b>	<b>0.00</b>	<b>0.00</b>	<b>3,675,513</b>
<b>Probable</b>	San Cristóbal	35,989	507	0.40	0.20	0.30	58,641
	San Pedro	3,365	340	0.90	0.00	0.10	368,157
	San Carlos	7,921	656	0.10	0.30	0.70	16,702
	La Plata	1,954	720	4.10	0.10	0.10	45,213
	Cimoide (La Plata)	5,691	414	3.00	0.00	0.10	75,814
	Paralela	4,491	688	0.00	0.10	0.20	99,339
	<b>TOTAL</b>	<b>89,695</b>	<b>465</b>	<b>0.80</b>	<b>0.10</b>	<b>0.20</b>	<b>1,341,953</b>
<b>Proven + Probable</b>		<b>343,046</b>	<b>454</b>	<b>0.80</b>	<b>0.10</b>	<b>0.10</b>	<b>5,017,466</b>

**Table 6.9 Mineral Resources exclusive of Reserves reported by CAM in October 2006**

Category	Vein	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Contained Ag oz
<b>Measured</b>	Animas	48,454	152	0.80	2.30	4.20	2,388,782
<b>Indicated</b>	Animas	688,786	137	0.50	2.30	4.20	3,037,544
<b>Measured + Indicated</b>		<b>1,173,326</b>	<b>143</b>	<b>0.70</b>	<b>2.30</b>	<b>4.20</b>	<b>5,426,326</b>
<b>Inferred</b>	San Cristóbal	135,513	407	0.20	0.30	0.40	1,771,635
	San Pedro	92,896	369	0.20	0.70	1.40	1,100,831
	San Carlos	16,626	766	0.20	0.50	1.20	409,654
	La Plata	40,540	663	2.50	0.20	0.70	863,893
	Cimoide (La Plata)	7,326	231	2.00	0.00	0.10	54,330
	Paralela	52,473	563	0.00	0.20	0.30	950,452
	Ramal Paralela	90,094	362	0.10	0.30	0.70	1,049,011
<b>Inferred (Total)</b>		<b>980,032</b>	<b>243</b>	<b>0.50</b>	<b>2.70</b>	<b>4.20</b>	<b>7,626,114</b>
<b>Inferred (Total)</b>		<b>1,415,499</b>	<b>305</b>	<b>0.40</b>	<b>2.00</b>	<b>3.10</b>	<b>13,825,919</b>

Mineral Resources and Reserves reported in the CAM 2009 Technical Report are reported as of December 31, 2008 and rely on data gathered by Minera Bateas and CMA. Mineral Reserves were reported above a breakeven NSR cut-off grade of US\$47.80/t (Table 6.10). Mineral Resources were reported above a NSR cut-off grade of US\$37.15/t (Table 6.11).

Metal prices used in the evaluation were US\$13.38/oz for Ag, US\$830.05/oz for gold, US\$1,698/t for lead, and US\$2,161/t for zinc. The NSR value for each metal used for reporting purposes was US\$0.27/g for silver, US\$9.80/g for gold, US\$11.51/% for lead, and US\$10.90/% for zinc.



**Table 6.10 Mineral Reserves reported by CAM as of December 31, 2008**

Category	Vein type	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
Proven	Silver Veins	421,320	387	0.83	0.01	0.02
	Polymetallic Veins	3,280,100	103	0.52	2.03	3.09
	<b>TOTAL</b>	<b>3,701,420</b>	<b>136</b>	<b>0.55</b>	<b>1.80</b>	<b>2.74</b>
Probable	Silver Veins	228,500	369	0.55	0.05	0.09
	Polymetallic Veins	103,000	426	0.44	1.74	2.41
	<b>TOTAL</b>	<b>331,500</b>	<b>387</b>	<b>0.51</b>	<b>0.58</b>	<b>0.81</b>
<b>Proven + Probable (All Veins)</b>		<b>4,032,920</b>	<b>156</b>	<b>0.55</b>	<b>1.70</b>	<b>2.58</b>

**Table 6.11 Mineral Resources exclusive of Reserves reported by CAM as of December 31, 2008**

Category	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Cu (%)	Width (m)
Measured	247,070	63	0.31	1.19	2.23	0.11	1.69
Indicated	20,400	71	0.29	1	1.4	0.15	2.74
<b>Measured + Indicated</b>	<b>267,470</b>	<b>64</b>	<b>0.31</b>	<b>1.18</b>	<b>2.17</b>	<b>0.11</b>	<b>1.77</b>
<b>Inferred</b>	<b>1,279,000</b>	<b>187</b>	<b>0.29</b>	<b>1.92</b>	<b>3.25</b>	-	<b>2.58</b>

The CAM 2008 Mineral Resources and Mineral Reserves represent the most recent independent evaluation of the Caylloma Property. The most recently filed Technical Report disclosing resources and reserves prior to this update was detailed in the Chapman & Kelly (2013) Technical Report as summarized in Table 6.12 and Table 6.13.

**Table 6.12 Mineral Reserves reported by Fortuna as of December 31, 2012**

Category	Vein type	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
Proven	Silver Veins	11,000	872	0.06	0.43	0.64
	Polymetallic Veins	1,242,000	92	0.33	1.48	2.20
	<b>TOTAL</b>	<b>1,253,000</b>	<b>99</b>	<b>0.33</b>	<b>1.47</b>	<b>2.19</b>
Probable	Silver Veins	246,000	386	0.96	0.31	0.51
	Polymetallic Veins	2,809,000	121	0.33	1.66	2.27
	<b>TOTAL</b>	<b>3,055,000</b>	<b>142</b>	<b>0.38</b>	<b>1.55</b>	<b>2.13</b>
<b>Proven + Probable (All Veins)</b>		<b>4,308,000</b>	<b>130</b>	<b>0.37</b>	<b>1.52</b>	<b>2.15</b>

**Table 6.13 Mineral Resources exclusive of Reserves reported by Fortuna as of December 31, 2012**

Category	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
Measured	431,000	72	0.30	0.88	1.53
Indicated	1,170,000	82	0.34	0.75	1.40
<b>Measured + Indicated</b>	<b>1,601,000</b>	<b>79</b>	<b>0.33</b>	<b>0.79</b>	<b>1.43</b>
<b>Inferred</b>	<b>6,633,000</b>	<b>101</b>	<b>0.27</b>	<b>1.84</b>	<b>2.58</b>

Since 2012 Minera Bateas and Fortuna have conducted annual Mineral Resource and Reserve updates, publishing the results in press releases (Fortuna, 2013; Fortuna, 2014; Fortuna, 2015; Fortuna, 2016).

## 6.4 Production

Historically the Caylloma area has been known as a silver producer. Past production has been from several vein systems that ranged from centimeters, up to 20 m in width. Individual ore shoots can strike for hundreds of meters with vertical depths ranging up to 300 m. Mining has historically taken place between the 4,380 masl and 5,000 masl.

### 6.4.1 Compania Minera Arcata

Production prior to 2005 came primarily from the San Cristobal vein, as well as from the Bateas, Santa Catalina and the northern silver veins (including Paralela, San Pedro, and San Carlos) with production focused on silver ores and no payable credits for base metals. During CMA management production parameters fluctuated during the late 1990's, as reserves were depleted. Owing to low metal prices, funds were not available to develop the Mineral Resources at depth or extend along the strike of the veins. Ultimately this resulted in production being halted in 2002. A summary of the production records at Caylloma under CMA management from 1998 through 2002 are included in Table 6.14. Production figures prior to 1998 are unavailable.

**Table 6.14 Production figures during CMA management of Caylloma**

Production	1998	1999	2000	2001	2002	Total
Ore processed (t)	125,509	129,187	167,037	180,059	164,580	766,372
Head grade Ag (g/t)	308	331	373	405	572	
Head grade Au (g/t)	1.27	0.89	0.67	0.60	0.23	
Recovery Ag (%)	85.1	87.7	87.0	87.2	87.4	
Recovery Au (%)	78.9	72.9	61.6	68.2	55.2	
Concentrate produced (t)	4,623	4,756	6,698	7,725	6,735	
Concentrate grade Ag (g/t)	7,115	7,913	8,097	8,235	12,209	
Concentrate grade Au (g/t)	27.29	17.68	10.31	9.45	3.05	
Production Ag (oz)	1,057,535	1,207,550	1,743,535	2,045,398	2,643,788	8,697,806
Production Au (oz)	4,051	2,697	2,218	2,347	659	11,973

### 6.4.2 Minera Bateas

Production under Minera Bateas management focused on the development of polymetallic veins producing lead and zinc concentrates with silver and gold credits. A summary of total production figures since the mine reopened in October 2006 are detailed in Table 6.15 with production rates increased at the operation in 2011 from 1,000 tpd to 1,300 tpd and again in May 2016 to approximately 1,430 tpd.

**Table 6.15 Production figures during Minera Bateas management of Caylloma**

Production	2006	2007	2008	2009	2010	2011
Ore processed (t)	33,460	250,914	331,381	395,561	434,656	448,866
Head grade Ag (g/t)	76	73	95	155	159	171
Head grade Au (g/t)	0.37	0.66	0.45	0.47	0.40	0.36
Head grade Pb (%)	1.12	1.70	2.48	3.10	2.44	2.15
Head grade Zn (%)	2.33	2.93	3.65	3.66	3.10	2.68
Production Ag (oz)*	55,529	442,741	805,056	1,685,026	1,906,423	2,008,488
Production Au (oz)*	166	3,328	2,197	2,747	2,556	2,393
Production Pb (t)	309	3,771	7,485	11,400	9,695	8,926
Production Zn (t)	603	6,300	10,561	12,900	11,855	10,625
Production	2012	2013	2014	2015	2016 <sup>#</sup>	TOTAL
Ore processed (t)	462,222	458,560	464,823	466,286	247,149	3,993,878
Head grade Ag (g/t)	177	173	174	136	96	147
Head grade Au (g/t)	0.40	0.36	0.31	0.26	0.19	0.38
Head grade Pb (%)	1.99	1.92	1.70	2.47	3.50	2.29
Head grade Zn (%)	2.56	2.83	2.97	3.84	4.45	3.20
Production Ag (oz)*	2,038,579	2,104,061	2,202,540	1,695,742	655,313	15,599,498
Production Au (oz)*	2,781	2,212	1,820	1,163	221	21,584
Production Pb (t)	8,113	8,065	7,326	10,811	8,134	84,035
Production Zn (t)	10,158	11,436	12,411	16,252	9,794	112,895

\* Recovery of silver and gold from lead and zinc concentrate

<sup>#</sup> Production till June 30, 2016

## 7 Geological Setting and Mineralization

The following description of regional and property geology is summarized from several reports including: Echavarria et al, (2006); CMA (2004); CAM (2006); CAM (2009); Chapman and Vilela (2012) and Chapman and Kelly (2013).

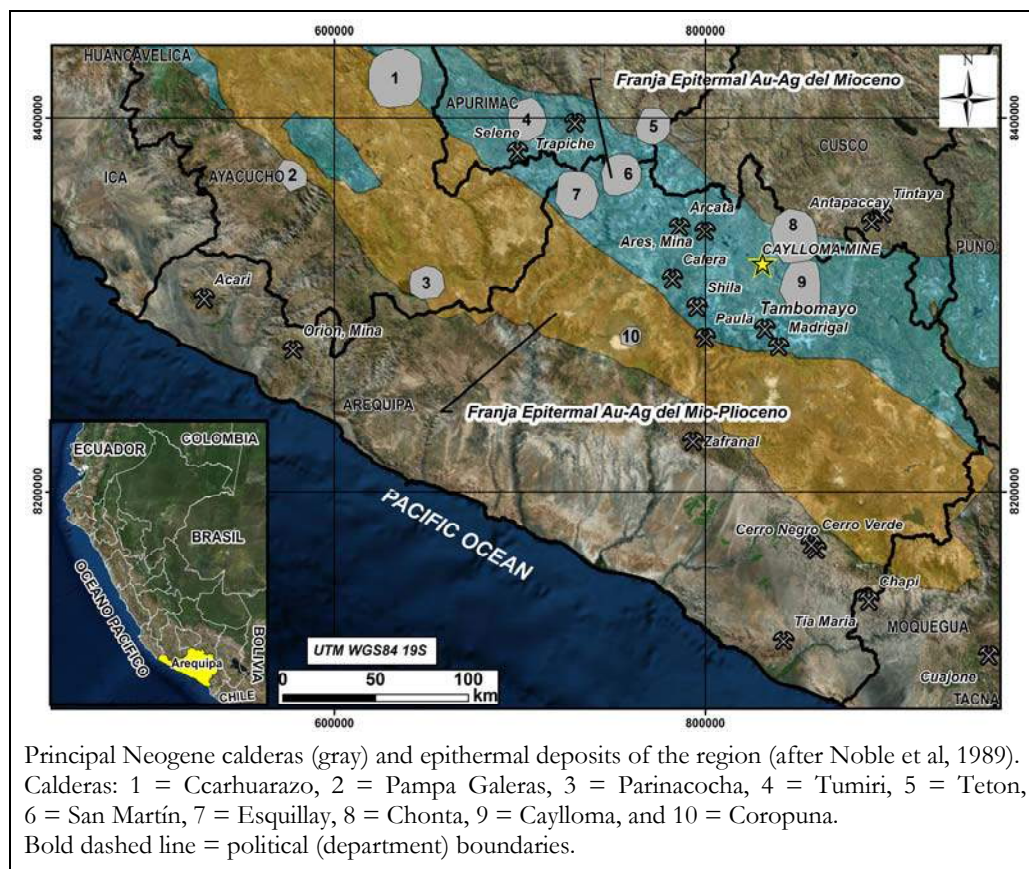
### 7.1 Regional geology

The Caylloma District is located in the Neogene volcanic arc that forms part of the Cordillera Occidental of southern Peru. This portion of the volcanic arc developed over a thick continental crust comprised of deformed Paleozoic and Mesozoic rocks.

Following the late Eocene to early Oligocene Incaic orogeny there was a period of erosion and magmatic inactivity prior to the eruption of the principal host rocks in the Caylloma District. Crustal thickening and uplift occurred between 22 Ma and 17 Ma accompanied by volcanism, faulting and mineralization in the Caylloma District.

The volcanic belt in the Caylloma District contains large, locally superimposed calderas (Figure 7.1) of early Miocene to Pliocene age comprised of calc-alkaline andesitic to rhyolitic flows, ignimbrites, laharic deposits, and volcanic domes that unconformably overlie a folded marine sequence of quartzite, shale, and limestone of the Jurassic Yura Group.

**Figure 7.1 Location map of the Caylloma District**



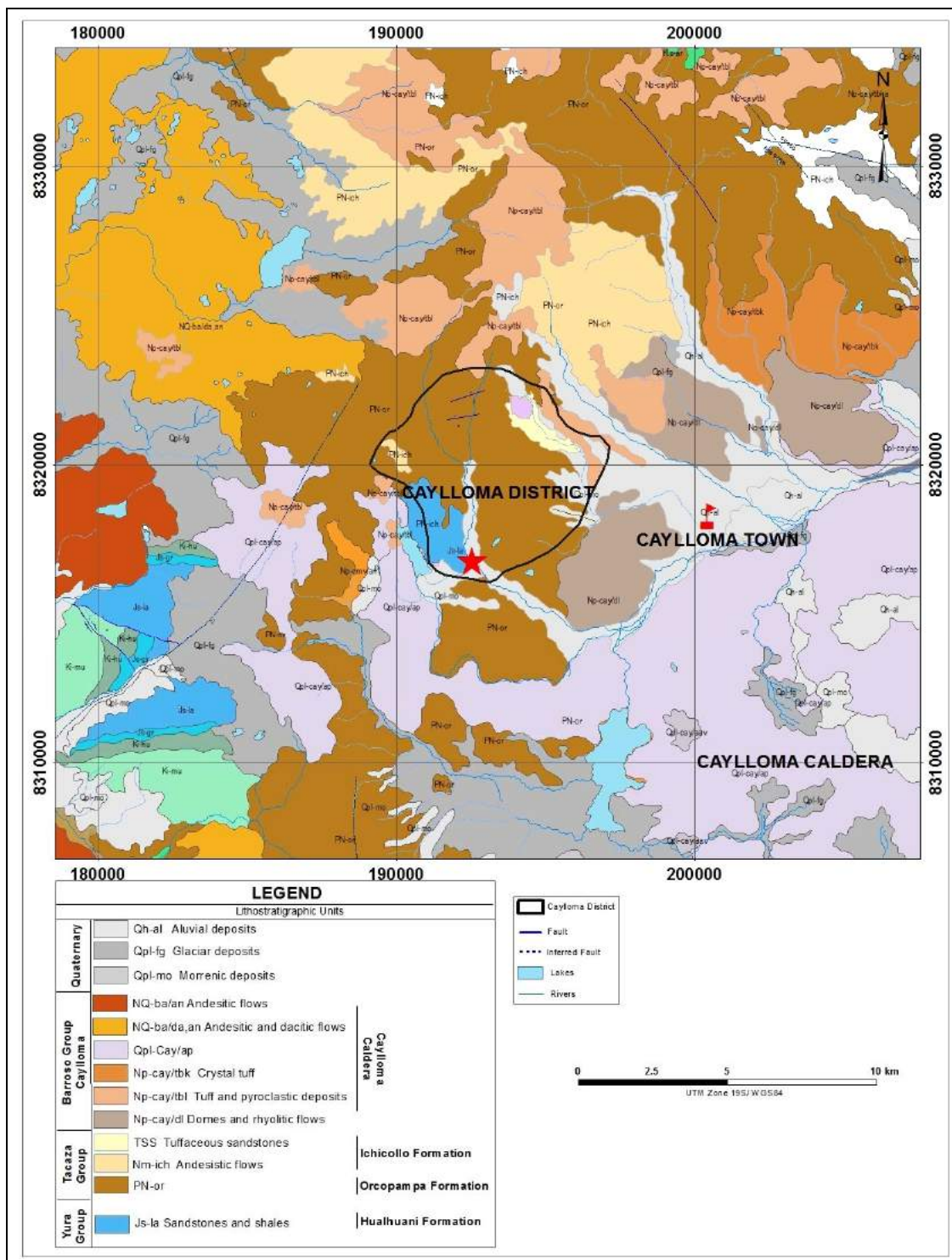




## 7.2 Local geology

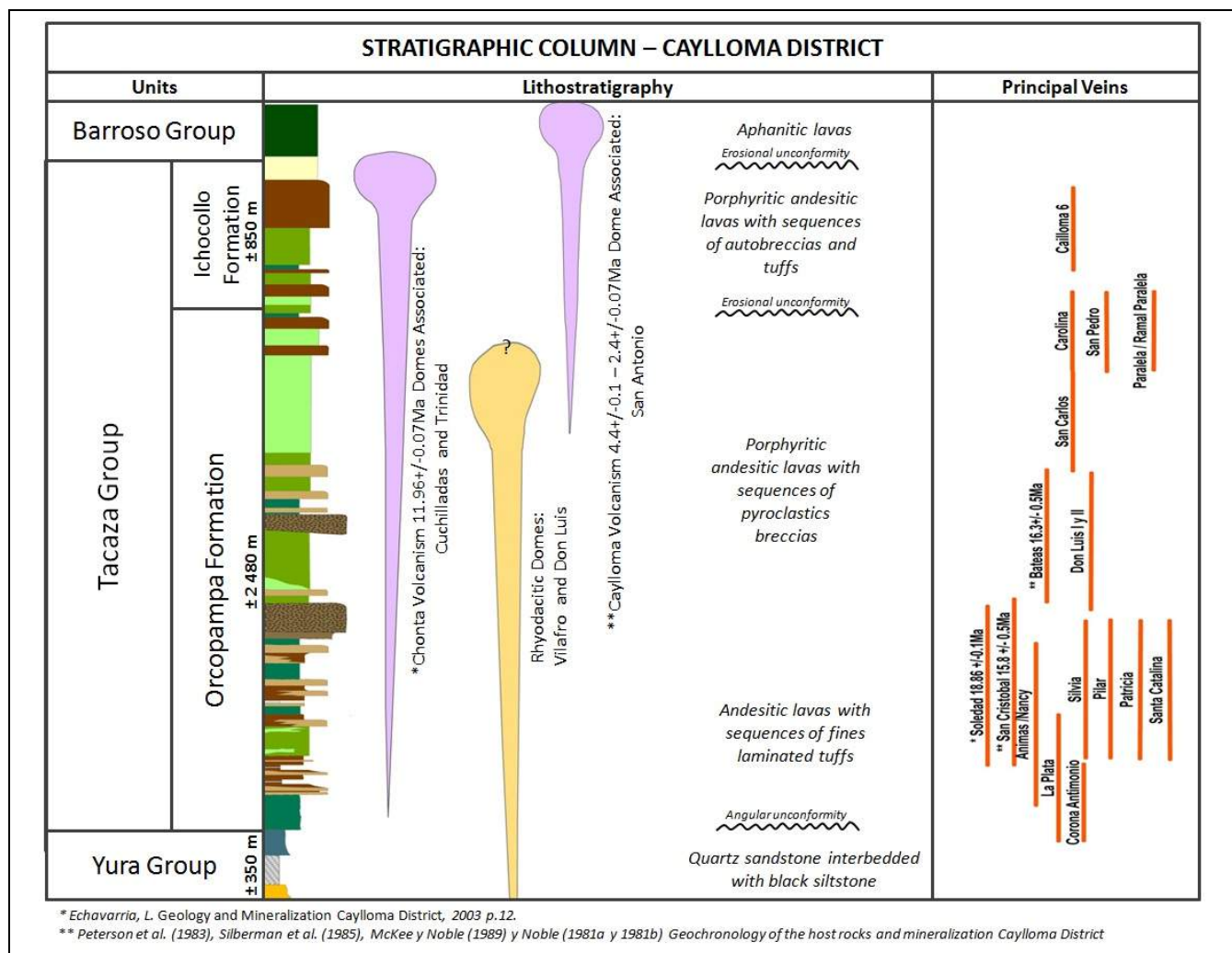
The mining district of Caylloma is located northwest of the Caylloma Caldera Complex (Figure 7.2).

**Figure 7.2 Local geologic map of Caylloma District (INGEMMET; Sheet 31-S)**



The host rock of the mineralized veins is volcanic in nature, belonging to the Tacaza Group (Figure 7.3). The volcanics of the Tacaza Group lie unconformably over a sedimentary sequence of orthoquartzites and lutites of the Jurassic Yura Group. Portions of the property are covered by variable thicknesses of post-mineral Pliocene-Pleistocene volcanics of the Barroso Group and recent glacial and alluvial sediments.

**Figure 7.3 Stratigraphic column of Caylloma District**



### 7.2.1 Yura Group

The oldest rocks exposed in the Caylloma District belong to the Yura Group of Upper Jurassic to Lower Cretaceous age. The Yura Group is composed of white to gray orthoquartzites, dark gray siltstones, and blackish greywackes, intercalated with thin layers of black lutites. The overall thickness of the group is approximately 400 meters.

Outcrop evidence indicates Yura strata are strongly deformed with the presence of recumbent kink folds with straight limbs and narrow hinges. However, strain in the Yura Group is locally weaker at depth where only open folds have been identified in the Caylloma mine area (Echavarria et al., 2006).

### 7.2.2 Tacaza Group

The Tacaza Group consists of a sequence of effusive lavas and tuff breccias intercalated with tuff horizons that lie in angular unconformity and in fault contact with rocks of the Yura Group.

The Tacaza volcanic group is comprised of lavas of intermediate to silicic composition with a porphyritic texture. The dominant color is reddish brown changing to greenish in areas of chloritic alteration. These volcanic rocks locally include a horizon of limestone that grades laterally to siltstone.

Estimated thickness of the Tacaza Group is 3,100 meters, with some sequences showing thinning of volcanic horizons along strike and down dip. The Tacaza Group is of Lower Miocene age.

The Tacaza Group includes the Orcopampa and Ichocollo Formations. The Orcopampa Formation (Bulletin 40 – Cailloma Quadrangle, Sheet 31-S, INGEMMET) unconformably overlies the Mesozoic sedimentary sequence of the Yura Group and is comprised of volcanoclastics, volcanic breccias and greenish to purplish gray lavas of andesitic composition. The Ichocollo Formation unconformably overlies the Orcopampa Formation and is considered the final stage of Tacaza volcanism. The Ichocollo Formation is exposed near San Miguel and Sukuytambo, located to the northeast of the Caylloma District and consists of lavas and dacitic domes in the basal section and andesitic to basaltic andesite flows in the upper section. The lavas are dark gray to gray in color and noticeably porphyritic.

### 7.2.3 Tertiary volcanic deposits

Overlying the Tacaza Group with unconformable contacts are andesitic lavas, rhyolites, dacites and tuffs belonging to the Barroso Group. They are generally present in prominent outcrops with sub-horizontal stratification and are Plio-Pleistocene in age.

### 7.2.4 Recent clastic deposits

Quaternary clastic deposits locally cover portions of the Caylloma Property. The valley floors and lower slopes are covered by alluvial material as well as glacial moraines, colluvium, and fluvio-glacial material.

### 7.2.5 Intrusive igneous rocks

The sedimentary and volcanic rocks in the Caylloma District have been intruded by post-mineral, fault-controlled rhyolitic domes (Cuchilladas and Trinidad domes) and dikes of the Chonta caldera sequence, characterized by coarse-grained quartz and sanidine phenocrysts, spherulites, and lithophysae, and well-developed laminations (Echavarria et al., 2006). In addition, recent mapping has identified outcrops of a rhyodacitic dome in the Vilafro area (Vilafro Dome) that host large alunite veins.

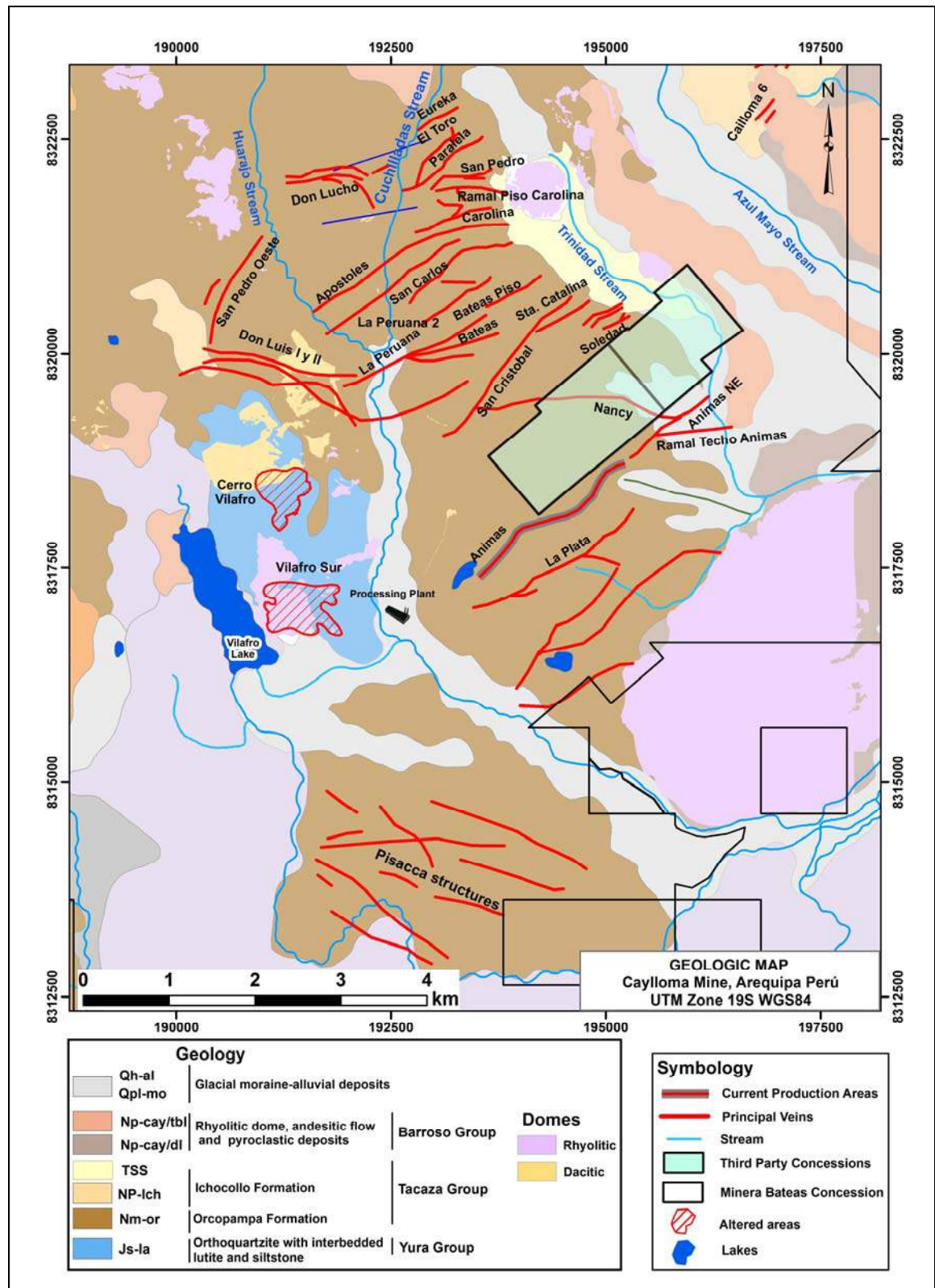
## 7.3 Property geology

The Caylloma Property is characterized predominantly by a series of faulted fissure vein structures trending in a northeast-southwest direction (Figure 7.4). Locally northwest-southeast trending veins are also present (for example, the Don Luis Vein).





Figure 7.4 Geology map of Caylloma Property showing vein systems



### 7.3.1 Epithermal mineralization

There are two distinct types of mineralization at the Caylloma Property, one with predominately elevated silver values (San Cristobal, La Plata, Bateas, San Carlos, Apostoles, San Pedro, El Toro and Trinidad veins), and the other being polymetallic with elevated silver, lead, zinc, copper, and gold values (Animas, Nancy and Santa Catalina veins).

A supergene oxide horizon has been identified which contains the following secondary minerals: psilomelane, pyrolusite, goethite, hematite, chalcocite, covelite and realgar (Corona and Antimonio veins). The oxide zone is thin, with no evidence of secondary silver enrichment.

### 7.3.2 Hydrothermal alteration

Three types of hydrothermal alteration have been identified at the Caylloma Property: (1) quartz-adularia; (2) quartz-illite; and (3) propylitic. The quartz-adularia (+pyrite +/- illite) alteration is restricted to the margins of the veins, with the thickness of the altered zone being generally proportional to the thickness of the vein. The width varies from a few centimeters to a few meters. Quartz replaces the volcanic matrix in the rocks, and quartz plus adularia occur as small veinlets or colloform bands. Pyrite is disseminated in the veinlets and in iron-manganese minerals in the wall rock. Illite is a product of alteration of the plagioclase and matrix of the volcanic host rocks. Quartz-adularia is absent in the upper parts of the vein systems. The alteration assemblage in the upper portions of the vein systems consists of a narrow selvage of quartz-illite near the vein. Quartz-illite grades into quartz-adularia at depth. Propylitic alteration is widespread throughout the property and may be regional in nature and unrelated to mineralizing events. The propylitic alteration is a fine aggregate of chlorite, epidote, calcite and pyrite.

## 7.4 Description of mineralized zones

Veins in the Caylloma District show structural patterns and controls typical of other vein systems hosted by Tertiary volcanic rocks in the western Peruvian Andean range. The Caylloma District vein system was developed as a set of dilatational structures as a consequence of tension generated during the main compressional event of the Andes. Veins are persistent along strike and dip. Locally, veins are displaced by post-mineral faulting along a north-northwest bearing. Horizontal displacement along these faults is minor and ranges from centimeters up to a few meters. No significant vertical displacement is observed on the structures. The vein system is not affected by any folding.

Veins are tabular in nature, with open spaces filled by episodic deposition of metallic sulfides and gangue minerals. According to Echavarría et al., (2006) most of the minerals, both silver and base metals, are related to the deposition of manganese mineralization occurring in bands, comprised of quartz, rhodonite, rhodochrosite and sulfides.

Vein systems at the Caylloma Property have a general northeast-southwest bearing and predominant southeast dip. Host rocks are pyroclastic breccias, effusive andesitic lavas and volcanoclastics of the Tacaza volcanic group.

There are two different types of mineralization at Caylloma; the first is comprised of silver-rich veins with low concentrations of base metals. The second type of vein is polymetallic in nature with elevated silver, lead, zinc, copper, and gold grades.

Mineralization in these vein systems occurs in steeply dipping ore shoots ranging up to several hundred meters long with vertical extents of over 400 meters. Veins range in thickness from a few centimeters to 20 meters, averaging approximately 1.5 meters for silver veins and 2.5 meters for polymetallic veins.

#### 7.4.1 Silver veins

The silver vein systems outcrop in the central and northern portions of the Caylloma District, with the best exposures of mineralization between the Santiago River, Chuchilladas and Trinidad streams. The mineralization is composed primarily of colloform banded rhodochrosite, rhodonite, and milky quartz, with silver sulfosalts present in certain veins. Vein systems extend to the eastern flank of the Huarajo Stream. Exposures in this area consist of quartz-calcite with low concentrations of manganese oxides. Silver veins can be sub-divided into two groups, 1) those that have sufficient geological information to support Mineral Resource estimates and 2) those that have been identified as exploration targets.

- 1) Bateas/Bateas Piso/Bateas Techo, La Plata/Cimoide La Plata, San Cristobal, San Pedro, San Carlos, Carolina, Don Luis II, and Paralela/Ramal Paralela
- 2) Eureka, Copa de Oro, El Toro, La Blanca, Santa Rosa, Santa Isabel, Trinidad, Elisa, Leona, Apóstoles, Jerusalén, Santo Domingo, La Peruana, Alerta, and Cercana

A more detailed description of the more important silver veins presently being exploited or explored is presented below.

##### Bateas/Bateas Piso & Bateas Techo

The Bateas vein splits into two branches, Bateas Techo is the southern branch, and Bateas is the northern branch. The Bateas Techo vein outcrops on surface for approximately 1,800 meters and can be traced from the escarpment of the Loma de Vilafro Hill extending to the northeast. At the summit of the hill the vein is covered by younger volcanic ash. Host rock is a volcanoclastic andesite with minor dacite and latite portions. The vein has a strike of 070° and dip of 82° to the southeast.

Polymetallic mineralization is present in two very well-defined zones. In the northeast, the vein contains chalcedonic and opaline quartz with disseminated silver sulfosalts, pyrite, and calcite. The southwestern end of the vein is characterized by a gangue of quartz, rhodonite and rhodochrosite containing veinlets of sphalerite, galena, chalcopryrite, and disseminated pyrite.

The northern branch of the Bateas vein, also known as the Bateas Piso vein, dips 52° to the northwest and has a strike parallel to the Bateas Techo vein. At its most northeastern extent it opens into a cymoid loop. Mineralization in the vein is characterized by base metal sulfides, sphalerite, galena, and disseminated pyrite in a gangue of quartz, calcite, rhodonite, and rhodochrosite.

##### La Plata & Cimoide La Plata

The La Plata vein is associated with fracture filling along a regional fault extending for more than 2 kilometers. The most representative part extends over approximately 400

meters and consists of quartz, calcite, rhodonite, and abundant manganese oxides in its central portion. The eastern portion of the vein consists of quartz with disseminated pyrite, and ruby silver stained with manganese oxides. The vein has been explored from surface downwards to level 7 (4,745 masl). A splay of the La Plata vein has been identified, being referred to as the Cimoide La Plata vein. It has the same characteristics of the La Plata vein with the vein being composed of gray silica with associated stibnite, pyrite and tetrahedrite. This cymoid has primarily been explored between level 7 and level 8 (4,745 masl and 4,695 masl).

#### San Cristobal

The San Cristóbal vein has a recognized strike length of 4 kilometers with a 035° to 055° northeast strike, and 50 to 80° dip to the southeast. Its thickness ranges from 5 to 6 meters at the upper levels to 2 to 2.5 meters at the 4,600 masl lower level (level 11). The primary sulfides in the vein are sphalerite, galena, polybasite, pyrrargyrite, chalcopyrite and tetrahedrite distributed in gangue of pyrite, quartz, rhodonite and calcite. This is the most extensively developed structure on the property. The silver values are highly variable along the strike and throughout the thickness of the vein, forming localized enrichments. Silver values have a tendency to decrease gradually at depth, as can be observed at levels 4,600 masl (level 10), 4,540 masl (level 11), and 4,500 masl (level 12).

#### San Pedro

The San Pedro vein outcrops for 900 meters on surface, with a general strike of 045° and dipping at 85° to the southeast. Thickness of the vein varies from 2 to 3 meters and shows banded mineralization consisting of quartz, rhodonite, and manganese and iron oxides, with concentrations of ruby silver and native silver. This vein has been traced and mined down to 4,610 masl (level 10 of the mine), and contains high-grade zones of up to 1,100 g/t Ag. The distribution of silver values in the vein shows a gradual decrease with depth. Core sampled from diamond drill holes drilled by CMA returned values ranging from 271 g/t Ag to 669 g/t Ag below 4,520 masl.

#### San Carlos

The San Carlos vein outcrops for approximately 300 meters on surface; having a strike direction of 045° and dip of 75° to the southeast. Thickness of the vein varies from 0.8 to 1.05 meters. The vein consists of tabular, open-space fillings with episodic periods of deposition. Most of the metals are related to the deposition of manganese minerals that occur in bands of quartz, rhodonite, and sulfides.

#### Paralela & Ramal Paralela

The Paralela and Ramal Paralela veins outcrop for 400 meters on surface with a general strike of 040° and dipping at 72° to the southeast. Thickness of the veins ranges from 1 to 1.25 meters. The veins consist of tabular, open-space fillings with episodic periods of deposition. Most of the metals are related to the deposition of manganese minerals.

#### Carolina

The Carolina vein outcrops for 500 meters on surface with a general strike of 075° and dipping at 73° to the southeast. Thickness of the vein ranges from 1.2 to 2 meters and was recognized and partially exploited with underground workings by CMA in 3 levels (4800, 4750 and 4700 masl). In the southwest, the vein has a banded and colloform texture, with assemblages of rhodonite, quartz, calcite and Ag sulfosalts; to the

northeast the vein has a brecciated texture with assemblages of quartz, calcite, Mn oxides and Ag sulfosalts.

During the development of the 2012 Exploration Program, mineralization was recognized over 900 meters along strike and extending to approximately 300 meters in depth (level 4600 masl).

#### Don Luis I & II

The Don Luis I & II veins outcrop for 1,000 meters at the surface, with a general strike between 95° to 115° and dipping at 40° and 68° to the southwest. Thickness of the veins ranges from 1.5 to 2 meters and has a brecciated texture composed of fragments of gray silica, tetrahedrite and stibnite.

Only limited exploration of the Don Luis veins was carried out by CMA and exploitation was restricted to minor workings on level 2 (4500 masl). Drilling carried out as part of the 2012-2014 exploration program demonstrated a mineralized column of approximately 300 meters for the Don Luis veins.

#### **7.4.2 Polymetallic veins**

A series of polymetallic veins has been identified in the southern and central portions of the Caylloma Property. These vein systems tend to be greater in strike length and thickness when compared to the silver vein systems. The main metallic minerals associated with the polymetallic veins are galena, sphalerite, pyrite, chalcopryrite, and in some zones pyrrargyrite. The polymetallic veins can also be sub-divided into two groups, 1) those that have sufficient geological information to support Mineral Resource estimates and 2) those that have been identified as exploration targets.

- 1) Animas, Animas NE, Santa Catalina, Soledad, Silvia, Pilar, Patricia, and Nancy veins
- 2) El Diablo, and Antimonio veins

More detailed descriptions of the more important polymetallic veins presently being exploited or explored are presented below.

#### Animas & Animas NE

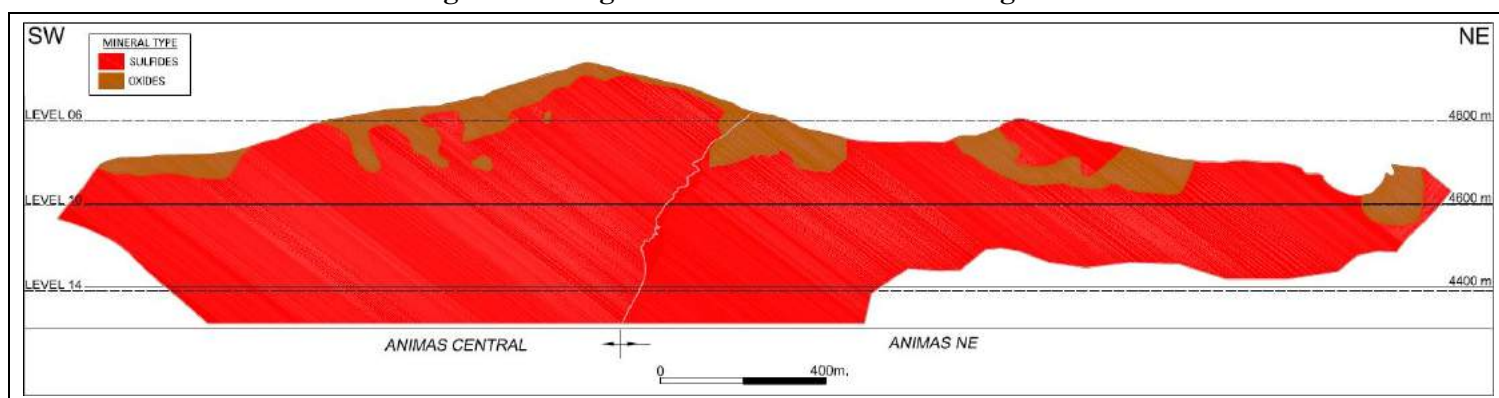
The Animas vein is one of the most prominent and well-defined structures in the southern portion of the Caylloma Property. It is a base metal-rich polymetallic vein that is divided into two parts based on a fault structure that disrupts the vein's continuity. The vein to the southwest of the fault is known as Animas whereas to the northeast of the fault the vein is referred to as Animas NE.

The Animas polymetallic vein is present from level 5 (4,850 masl) to below level 12 (4,495 masl) in the mine. Several wide zones (over 12 to 14 meters in thickness) are observed in levels 6, 9 and 10 (4,800 masl, 4,645 masl, and 4,595 masl respectively), especially in lateral exploration cross-cuts. The vein outcrops along 1.5 kilometers with silicified exposures stained with manganese oxides and has been identified through diamond drilling over a total strike length of 3.8 kilometers. Vein thickness ranges to 16 meters, but averages approximately 4 to 5 meters. Current exploitation has identified widths of up to 16 meters in level 9 (4,650 masl) and 10 meters in level 12 (4,500 masl) where it forms a sigmoidal loop approximately 300 meters in length with widths between 2.5 to 12.40 meters in the extreme northeast.

Vein mineralogy includes argentiferous galena, sphalerite, marmatite, and chalcopryite accompanied by minor tetrahedrite and ruby silver. Gangue minerals are pyrite, quartz, calcite, rhodonite, rhodochrosite, and iron-manganese oxides displaying banded, colloform, and brecciated textures.

The mineralization present in all veins is sulfide with the exception of the uppermost portions of the Animas/Animas NE veins. The Animas vein has been explored close to the surface and a supergene oxide horizon has been identified extending to a variable depth below the surface based on the presence of iron oxides and lesser amounts of manganese oxides. Figure 7.5 displays the extent of the oxide horizon in the Animas vein.

**Figure 7.5 Long section of Animas vein showing oxide-sulfide horizon**



### Santa Catalina

Surface outcrops of the Santa Catalina vein extend over a distance of 700 meters along a strike of between 245° to 260°, dipping at 65° to 80° to the northwest with an average thickness on surface of 1.90 meters. The vein contains silver sulfosalts (pyrargyrite and proustite), sphalerite, galena and chalcopryite in a gangue of quartz, calcite, rhodonite, and rhodochrosite. The host rock is an andesite that exhibits pseudo-stratification flow banding and massive coherent structures. Tectonic breccias are present in the footwall and hanging wall of the vein. Minera Bateas has mined to 4,720 masl, below level 8, and diamond drilling has intercepted the vein to 4,773 masl (level 9), where polymetallic mineralization is present in well-defined fault-controlled zones. A base-metal-rich zone is present between 4,720 masl (level 8) and 4,773 masl (level 9). The average thickness of the vein is 2.5 meters.

### Soledad

The Soledad vein is exposed at the surface for approximately 250 meters, being located to the northeast of the Santa Catalina vein. It has a strike of 248° to 251° and a dip of 76° to the northwest. The average thickness of the vein at the surface is 0.5 meters. During 2012 the vein was exploited between Level 6 (4,820 masl) to below level 7 (4,750 masl). Exploration through diamond drilling and underground mine workings have confirmed the vein continues down to at least level 8 (4,720 masl). The vein has an average thickness at depth of 1.1 meters. The mineralization is polymetallic in nature, containing silver sulfosalts, sphalerite, galena, chalcopryite, gray copper (enargite) and disseminated pyrite. The vein is banded with two recognized events: (1) an early phase, rich in base metal sulfides and elevated gold values in banded rhodonite, and (2) a

second phase of quartz, rhodochrosite, with disseminated silver minerals and veinlets. The host rock is flow banded andesite with intercalated volcanic sediments.

#### Silvia

The Silvia vein is discontinuously exposed on the surface over a strike distance of approximately 200 meters. The thickness of the vein ranges from 0.8 to 1.8 meters and the strike ranges between 250° and 262°. The vein dips to the northwest between 65 ° and 82°. Mineralization is polymetallic, with sphalerite, galena, chalcopryrite, and silver sulfosalts (pyrargyrite) present in a gangue of quartz, calcite, rhodonite, and rhodochrosite. The vein has a banded to massive texture with bands of base-metal sulfides of variable thickness.

#### Pilar

The Pilar vein is considered to be part of the San Cristóbal system. The vein has been identified over a strike length of 85 m in a gallery at level 8 of the San Cristóbal underground workings. It appears to be a tensional feature of the San Cristóbal vein with banded rhodonite and quartz texture with disseminated sulfides of sphalerite, galena, and silver sulfosalts. The average thickness of the vein is 2 m, with a strike direction of 153° and dipping at 48° to the southwest.

#### Patricia

The Patricia vein is a fissure-type structure, composed primarily of banded rhodonite, quartz, and rhodochrosite with mineralization present as veins and lenses in the bands of quartz/rhodonite, as well as being associated with fault zone structures and hydrothermal alteration in the host rock.

#### Nancy

The Nancy vein outcrops discontinuously over a distance of approximately 1,000 meters. The strike of the vein ranges between 110° to 120° while dipping 60° to 70° to the southwest. The width of the vein ranges from 0.5 to 4.5 meters, being wider near its intersection with the Animas vein. Mineralization is polymetallic in a gangue consisting of quartz and iron and manganese oxides. The metallic minerals of economic importance are galena, sphalerite and chalcopryrite. During 2012, the Nancy vein was explored by diamond drilling over approximately 400 meters of its strike length and to a depth of approximately 250 meters (elevation 4,420 masl).

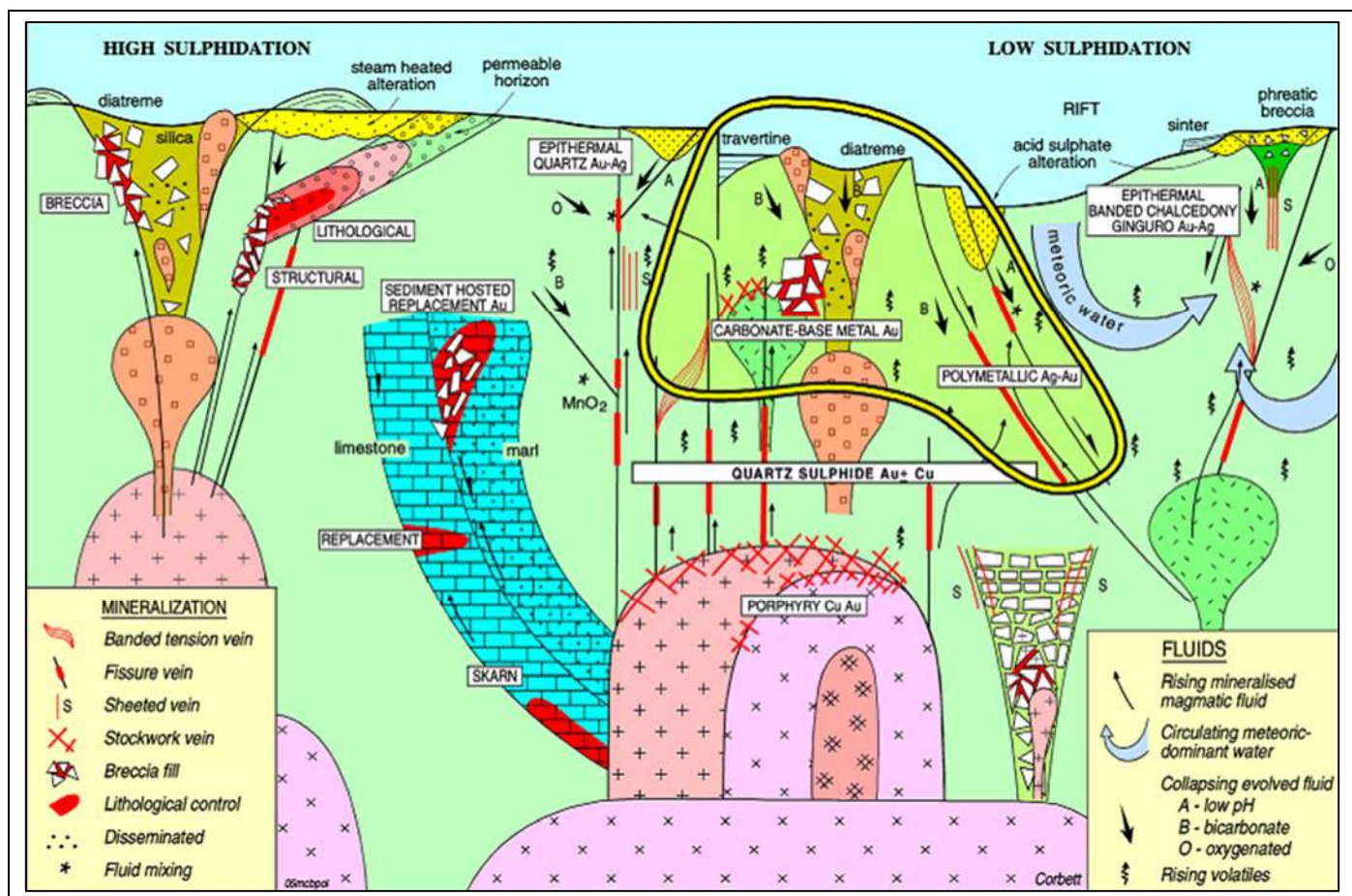


## 8 Deposit Types

The Caylloma polymetallic and silver-gold rich veins are characteristic of a typical low sulfidation epithermal deposit according to the classification of Corbett (2002) having formed in a relatively low temperature, shallow crustal environment (Figure 8.1). The epithermal veins in the Caylloma District are characterized by minerals such as pyrite, sphalerite, galena, chalcopryrite, marcasite, native gold, stibnite, argentopyrite, and various silver sulfosalts (tetrahedrite, polybasite, pyrargyrite, stephanite, stromeyerite, jalpate, miargyrite and bournonite). These are accompanied by gangue minerals such as quartz, rhodonite, rhodochrosite, johannsenite (Mn-pyroxene) and calcite.

The characteristics described above have resulted in the Caylloma veins being classified as belonging to the low sulfidation epithermal group of precious metals in quartz-adularia veins similar to those at Creede, Colorado; Casapalca, Peru; Pachuca, Mexico and other volcanic districts of the late Tertiary (Cox and Singer, 1992). They are characterized by Ag sulfosalts and base metal sulfides in a banded gangue of colloform quartz, adularia with carbonates, rhodonite and rhodochrosite (Echavarría et al., 2006). Host rock alteration adjacent to the veins is characterized by illite and widespread propylitic alteration.

**Figure 8.1 Idealized section displaying the classification of epithermal and base metal deposits sourced from Corbett (2002)**





## 9 Exploration

Mining activity in the Caylloma District dates back to workings by Spanish miners in the 1620s. English miners carried out activities in the late 1800s and early 1900s. The property was acquired by Compania Minera Arcata in 1981 who implemented a series of exploration programs to complement their mining activities prior to the closure of the operation in 2002.

Fortuna acquired the property in 2005 and placed it into production in September 2006 with a refurbished mill. Fortuna has continued to conduct extensive exploration of the property since the acquisition.

### 9.1 Exploration conducted by Compania Minera Arcata

There is no information available to detail the exploration conducted by CMA at the Caylloma Property.

### 9.2 Exploration conducted by Minera Bateas

Since 2005 exploration activities have been directed by Fortuna.

#### 9.2.1 Geophysics

In 2007, induced polarization (IP) and resistivity studies were conducted by Arce Geophysics over the Nancy and Animas NE veins covering an area of seven square kilometers. The survey was performed using an IRIS ELREC Pro receptor with a symmetrical configuration poly pole array with spacing of 50 meters between electrodes.

Results of the geophysical studies identified three coincident zones of low IP potential associated with high chargeability and resistivity. The three geophysical anomalies were investigated through a targeted drilling campaign.

In 2012, magnetometry, induced polarization (IP) and resistivity studies were carried out by Quantec Geoscience over Cerro Vilafro and Vilafro South, covering an area of 17 square kilometers in IP/resistivity studies with a pole-dipole array configuration with spacing of 50 meters between electrodes and 31.6 line kilometers in magnetometry studies. The surveys successfully identified coincident chargeability and resistivity anomalies in the Cerro Vilafro area.

In 2015 CSAMT (Controlled-source Audio-frequency Magnetotellurics) geophysical surveys were completed covering the northeastern projection of the San Pedro and Paralela veins. Similar CSAMT geophysical surveys were completed in 2016 covering the Pisacca exploration target area. In both areas, the CSAMT surveys were successful in identifying resistivity anomalies spatially associated with the projections of mapped vein structures. The 2015 and 2016 geophysical surveys were carried out by Quantec GeoScience.

#### 9.2.2 Surface channel sampling

Extensive surface channel samples have been taken along all principal mineralized structures identified in the Caylloma District.

The sampling process consists of making a channel perpendicular to the structure at variable intervals along the strike of the structure. Sampling is conducted according to

lithological or mineralogical characteristics with sample lengths ranging from 0.2 meters to 1.0 meter. Care is taken to ensure samples are representative, homogeneous and free of contamination.

Channel widths vary between 0.2 and 0.3 meters. Channels are cleaned beforehand by removing a layer of approximately 2 centimeters of surface material, which tends to be highly weathered and not representative of the structure. Once the surface material is removed, the sample is extracted using a hammer and chisel, with the average sample weight being 3 kilograms.

The sample is bagged and a label inserted recording the following information: channel azimuth and inclination, structural, lithological and mineralogical descriptions. The UTM coordinate of the first sample is recorded using a handheld GPS. The spatial locations of subsequent samples in the channel are estimated from the first sample according to the azimuth and inclination of the channel and the length of each sample.

Exploration has focused on the delineation of major vein structures such as the Animas, Bateas, Santa Catalina, Soledad and Silvia veins. Additional exploration has also been conducted to define the mineral potential of other veins on the property such as the Carolina, Don Luis and Nancy veins (Figure 9.1).

Surface channel samples are not used for Mineral Resource estimation but as a guide for exploration drilling and to identify the vein structure on surface.

### 9.2.3 Mapping

#### Animas

During 2006 and early 2007, a surface mapping campaign of the Animas vein structure was conducted in the northeastern portion of the property. The mapping identified discontinuous outcrops of vein quartz and occasional brecciated zones (quartz and rhodonite) covered by a manganese oxide cap. Surface mapping was complemented by a drilling campaign (described in Section 10) that confirmed the continuity of the Animas structure at depth.

Exploration activities of the Animas vein resumed in 2010, during underground development of level 6 (4,800 masl); brecciated mineralization was discovered with fragments of rhodochrosite and rhodonite in quartz and silica matrix, with disseminations and veinlets of galena and silver sulfosalts.

#### Antimonio

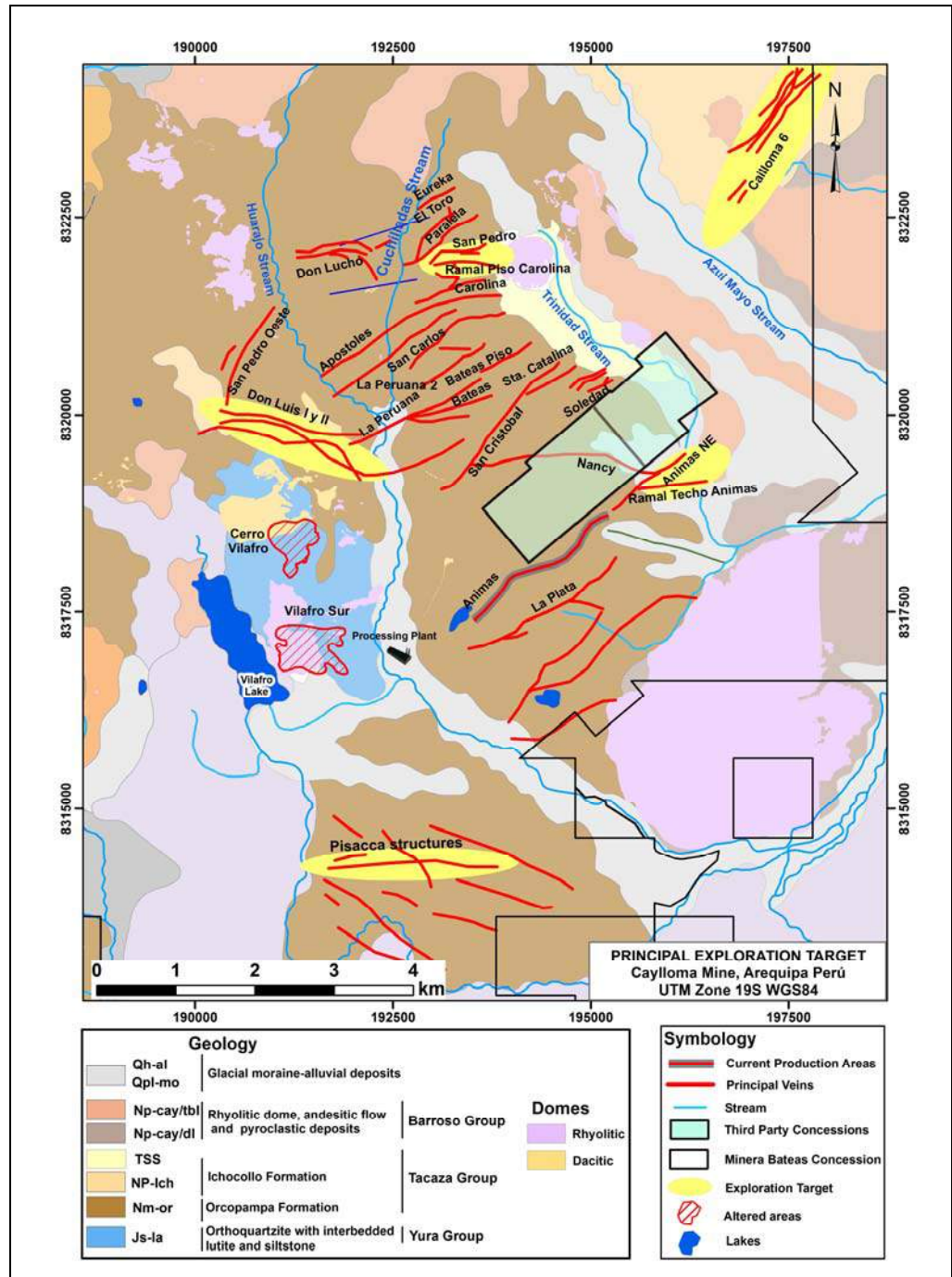
This Antimonio vein was first recognized in the 1980s with the mapping of approximately 300 meters of outcropping vein, with an average surface thickness of 2.0 meters and consisting of massive milky quartz with traces of stibnite. In 2006, the mapping was reviewed and a limited drill program executed. In 2011 as part of the Southern Sector Exploration Program of the Caylloma Property, geological mapping and geochemical analysis identified the presence of the vein over a total distance of one kilometer striking in a northeast to southwest direction. Geochemical sampling of the vein returned values of up to 3.13 g/t Au, 401 g/t Ag and Sb concentrations exceeding 10,000 ppm, as well as elevated arsenic and base metal grades. The presence of stibnite in this vein suggests a later stage of mineralization.



### Bateas

Exploration by Fortuna of the Bateas vein has been ongoing since 2007. Initial work involved surface mapping and the sampling of outcrops that returned anomalous silver grades. Based on the initial results a diamond drill program from surface was conducted in late 2007 and early 2008. Exploration has been conducted from the surface as well as from underground workings of the mine.

**Figure 9.1 Plan map showing principal exploration targets**



### Silvia

The Silvia vein outcrops on surface discontinuously over a distance of approximately 200 meters, varying in thickness from 0.80 to 1.80 meters with a variable strike direction of between 250° to 262° and dipping at 65° to 82° to the northwest. The vein is composed of rhodonite, rhodochrosite, quartz and calcite associated with sulfides such as sphalerite, galena, chalcopryite and sulfosalts of silver (pyrargyrite). It has a banded to massive texture with varying band widths of basic sulphides and gangue minerals. The host rock is an andesitic volcanic rock with propylitic-chloritic alteration.

### Soledad

The Soledad vein has been mapped on surface over a length of 250 meters running parallel with the Santa Catalina vein, and displaying a similar strike (248° to 251°) and dip (76° to the northwest). The vein is approximately 0.45 meters in thickness, having a banded texture consisting of sphalerite, galena, chalcopryite, gray copper, silver sulfosalts, and disseminated pyrite. Two well-defined mineralization events have been identified in the vein; the first event corresponds to banded rhodonite with the presence of anomalous gold sulfides, and a second event, which disrupts the first, consisting of rhodochrosite with disseminated silver and quartz veinlets.

### San Cristobal

There has been limited new exploration by Minera Bateas of the San Cristóbal vein as significant information regarding the structure was available from historical underground workings. San Cristóbal is one of the most prominent veins of the Caylloma District and is known to have higher grade silver concentrations compared to other veins at the property. From 2006 to 2008 exploration drilling was conducted in order to explore the mineralization potential at depth. In 2011 underground exploration was conducted through 578 meters of new mine workings on level 11, comprising 282 meters of galleries with the remaining development comprising bypasses, cross-cuts, and chimneys. Underground observations identified a banded structure averaging 2.4 meters in width and averaging 128 g/t Ag, consisting of quartz veinlets, calcite, and rhodonite with veinlet and disseminated silver sulfosalts.

During 2012, 489 meters of additional underground workings were executed on level 11.

### Nancy

From 2006 to 2008 reconnaissance work and geological mapping were conducted over portions of the Nancy vein not covered by glacial moraine deposits. Surface samples returned anomalous values of up to 461 g/t Ag and 5.63 g/t Au. In 2007, resistivity and induced polarization geophysical surveys were conducted in the area, with high chargeability anomalies providing evidence of potential mineralization. Exploration drilling has confirmed the presence of an important mineralized structure, open laterally and to depth.

### La Plata

The La Plata vein is associated with infilling of a fault striking northeast and dipping 60° to the southeast. The vein has been mapped over a length of 1,400 meters, having an average width of 2.5 meters.

Mineralogy consists of quartz, calcite, banded rhodonite, johannsenite (silicate of calcium and manganese) in the presence of silver sulfosalts, tetrahedrite and manganese

oxides. In the first half of 2011, exploration of the vein was carried out with geological mapping and geochemical surface sampling. This involved a reinterpretation of the structure and excavation of exploratory trenches in the far northeastern extension of the vein, and the taking of 160 channel samples that returned values of up to 0.36 g/t Au, 302 g/t Ag and locally Sb values exceeding 10,000 ppm.

#### Vilafro

In December 2005 samples were collected from the 900 ha Vilafro area in relation to silica-alunite anomalies identified in ASTER images. In mid-2006, a review of the Vilafro surface geology was performed followed by geologic mapping and sampling in 2007.

During 2012, geochemical information from previous campaigns was compiled and reinterpreted. Detailed geological mapping was carried out at a 1:1,000 scale and grid geochemical sampling and geophysical surveys of magnetics, chargeability and resistivity were completed. Based on the work executed, potential exploration targets were identified in the Cerro Vilafro and Vilafro Sur areas.

#### Cerro Vilafro

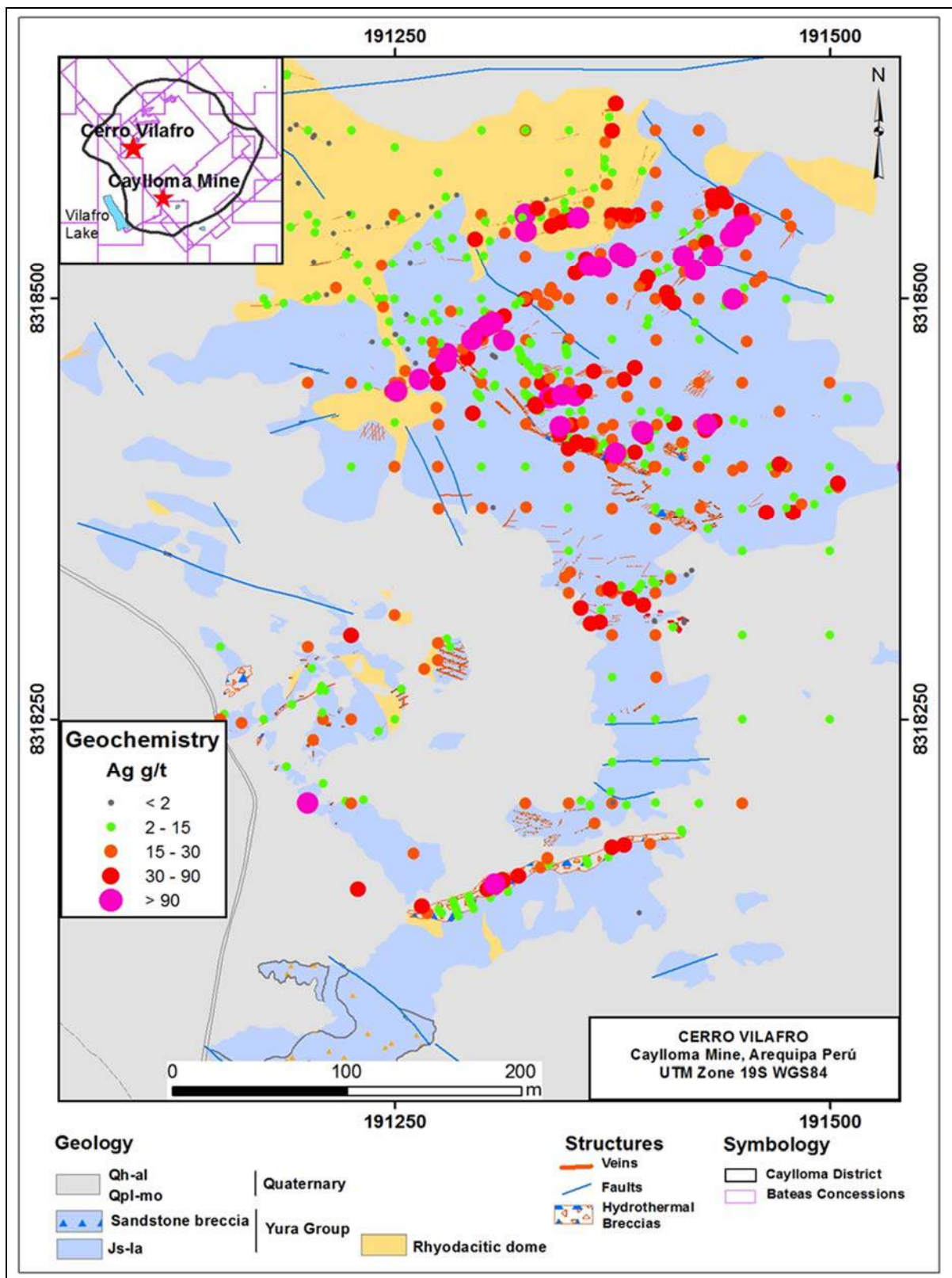
Detailed surface mapping and channel sampling in the Cerro Vilafro area, located proximal to the Caylloma plant site, identified strong silver and gold values associated with a NE-SW trending vein swarm. The mineralization is hosted by Cretaceous quartzites and was evaluated as a potential bulk-minable, open-pit target. Sampling reported high-grade gold and silver values over narrow widths of veins and hydrothermal breccias. Sampling of zones of quartz veinlets between the primary structures resulted in lower silver and gold values (Figure 9.2).

Highlights of the surface channel sample results at Cerro Vilafro include the following mineralized intervals:

- CH 503715: 0.40 m averaging 3.23 g/t Au and 827 g/t Ag
- CH 503708: 0.40 m averaging 2.14 g/t Au and 2,440 g/t Ag
- CH 503716: 0.95 m averaging 0.83 g/t Au and 459 g/t Ag
- CH 503726: 0.25 m averaging 0.57 g/t Au and 791 g/t Ag
- CH 503615: 0.60 m averaging 0.41 g/t Au and 661 g/t Ag



Figure 9.2 Plan map showing surface geology and geochemistry of Cerro Vilafro



### Vilafro Sur

The Vilafro Sur lithocap is characterized by advanced argillic alteration assemblages extending over 1,000 meters in a NW-SE direction and ranging up to approximately 400 meters in width. The lithocap is open to the northwest and may extend beneath the Laguna Vilafro. The main portion of the lithocap outcrops from approximately 4,700 to 4,860 masl.

Surface geochemical values indicate that the alunite-bearing lithocap is generally barren of significant metal or pathfinder elements:

- Au: low, ranging to maximum of 32 ppb
- Ag: low, generally less than 5 ppm
- Ag/Au ratio: low, ranging from 10 to 74
- As: generally low, ranging to 90 ppm, a few values greater than 300 ppm with a maximum value of 1,230 ppm
- Ba: moderately to strongly anomalous with values generally in the 100 to 500 ppm range; maximum of 1,220 ppm
- Bi: low, generally below detection limit, one anomalous value of 39 ppm
- Cu: generally low with values ranging to approx. 35 ppm; maximum value of 224 ppm
- Hg: generally less than 2 ppm
- Mo: low, generally less than 5 ppm; one anomalous value of 39 ppm
- Pb: low, generally less than 50 ppm, a couple of outlier values ranging to 150 ppm
- Sb: low to moderately anomalous ranging to 50 ppm; maximum value of 117 ppm
- Zn: low, generally less than 50 ppm, single outlier value of 228 ppm

The geochemical signature of the Vilafro Sur lithocap is similar to that found at certain high sulfidation style deposits.

### Cailloma 6

Detailed surface mapping and channel sampling in the Cailloma 6 concession area identified a prominent vein striking 035° and dipping 80°-85° to the southeast. The length of the outcropping vein is approximately 1,650 meters with widths ranging from 0.2 to 0.8 meters. To the northeast, the veins form a sigmoidal loop of 500 meters length with three splits of 100 to 150 meters of length. The host rock is andesitic flows with a porphyritic texture.

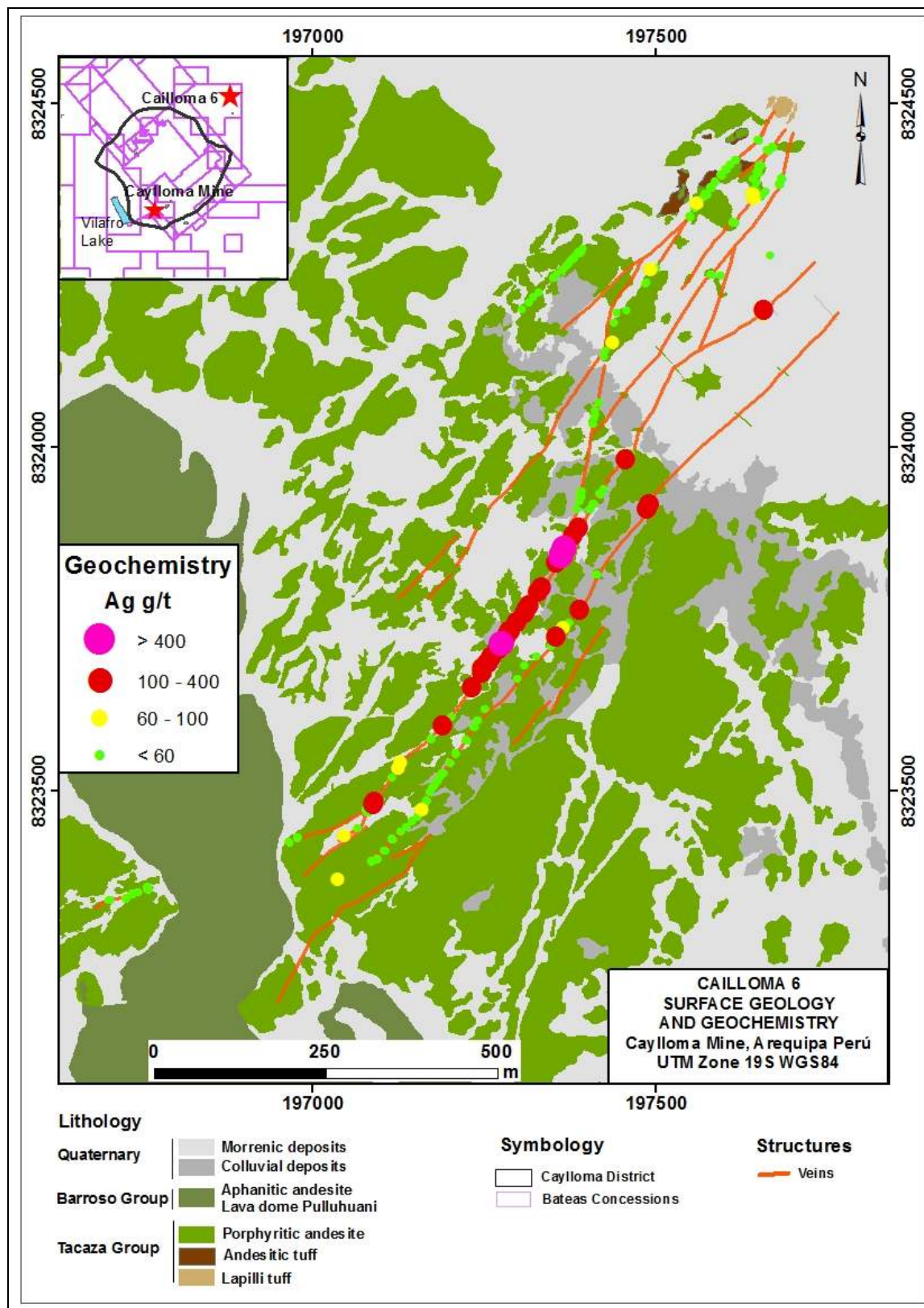
The mineralization is composed by veinlets and cavity fillings of quartz with crustiform texture, silver sulfosalts disseminations, hematite, goethite, and manganese oxides. The hydrothermal alteration bordering the vein is comprised of silicification with associated illite-pyrite mineralization ranging in width up to 3.5 meters.

The Cailloma 6 veins are controlled by longitudinal faults with transverse faulting affecting the structure with small dextral and sinistral displacements (Figure 9.3).





Figure 9.3 Plan map showing surface geology and geochemistry of Cailloma 6





Highlights of the surface channel sample results include the following mineralized intervals:

- CH 505473: 0.70 m averaging 0.184 g/t Au and 776 g/t Ag
- CH 505469: 0.20 m averaging 0.382 g/t Au and 419 g/t Ag
- CH 505510: 0.70 m averaging 0.141 g/t Au and 122 g/t Ag
- CH 504999: 0.25 m averaging 0.667 g/t Au and 82 g/t Ag
- CH 505450: 0.30 m averaging 0.511 g/t Au and 267 g/t Ag

#### 9.2.4 Recent exploration activities

During 2012 a regional mapping and stream sediment sampling of the areas surrounding the Caylloma District were executed at a scale of 1:10,000 covering 19,500 hectares of new concessions applied for in 2011.

Among the exploration targets identified was the Pisacca area (Fig. 9.1). The area is characterized by silicified and brecciated vein-like structures with advanced argillic alteration assemblages and weak to moderate geochemical anomalies typical of a high sulfidation epithermal system. CSAMT surveys carried out in early to mid-2016 demonstrated the presence of strong resistivity anomalies associated with the mapped structures.

## 10 Drilling

Exploration and definition drilling has been conducted at the Caylloma Property by both CMA and Minera Bateas. Diamond drilling has been the preferred methodology with all other drilling techniques being unsuitable due to the terrain and the required depths of exploration.

### 10.1 Drilling conducted by Compania Minera Arcata

Minera Bateas were able to recover and validate information on 43 diamond drill holes totaling 7,159.32 m drilled by CMA between 1981 and 2003 on the Caylloma Property. It is unlikely these are the only holes drilled over this period but data on additional drill holes could not be recovered and validated. Table 10.1 details the CMA exploration drilling information retrieved by Minera Bateas.

**Table 10.1 Exploration drilling conducted by CMA**

Vein	Surface Drill holes		Underground Drill holes	
	Number	Meters	Number	Meters
San Pedro	-	-	8	1,252.85
San Cristóbal	2	882.65	18	1,903.20
Don Luis	-	-	1	130.87
Don Luis I	-	-	2	252.90
Elisa	-	-	2	239.10
La Plata	9	2,228.95	-	-
Ramal San Pedro	1	268.80	-	-
<b>TOTAL</b>	<b>12</b>	<b>3,380.40</b>	<b>31</b>	<b>3,778.92</b>

### 10.2 Drilling conducted by Minera Bateas

As of June 30, 2015, Minera Bateas completed 879 drill holes on the Caylloma Property totaling 141,100.65 meters since the company took ownership in 2005. All holes are diamond drill holes and include 424 from the surface totaling 101,608.55 meters, and 455 from underground totaling 39,492.10 meters. Table 10.2 provides a summary of the drilling through June 30, 2015.

The locations of surface drill holes drilled by Minera Bateas at the Caylloma Property are displayed in Figure 10.1.

**Table 10.2 Exploration drilling conducted by Minera Bateas**

Vein	Year	Surface drilling		Underground drilling	
		Number	Meters	Number	Meters
<b>Animas &amp; Animas NE</b>	2005	0	0.00	94	2,028.00
	2006	37	7,638.75	2	110.65
	2007	32	8,770.35	0	0.00
	2008	10	3,666.10	0	0.00
	2010	21	2,300.45	9	805.40
	2011	12	3,411.10	10	1,745.75
	2012	18	4,966.20	30	3,944.10
	2013	0	0.00	9	1,881.95
	2014	9	1,858.00	16	1,783.80
	2015*	0	0	1	72.10



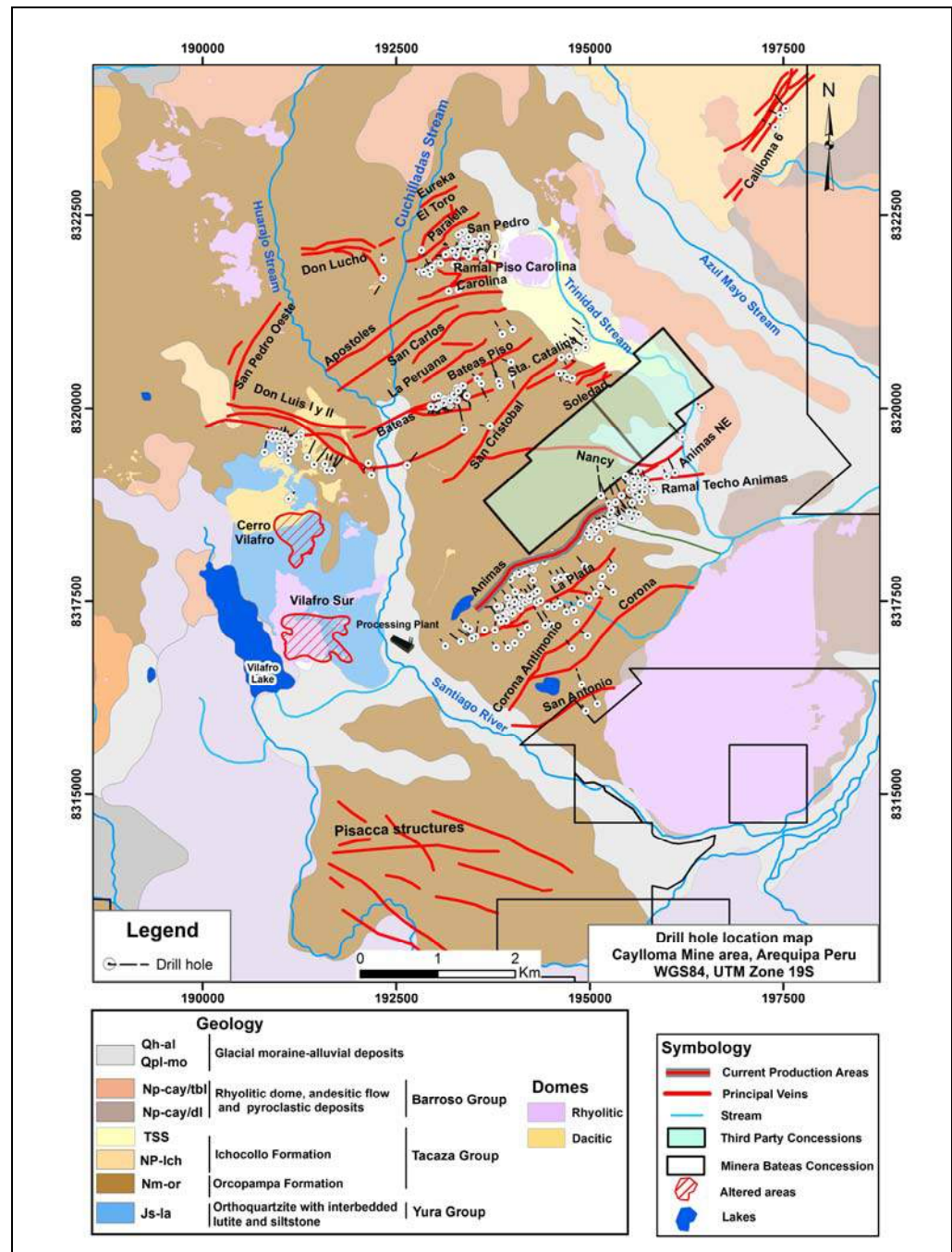
Vein	Year	Surface drilling		Underground drilling	
		Number	Meters	Number	Meters
<b>Antimonio &amp; Corona Antimonio</b>	2006	5	1,117.50	0	0.00
<b>Bateas</b>	2007	7	2,786.10	0	0.00
	2008	4	1,594.20	0	0.00
	2009	0	0.00	10	829.50
	2010	0	0.00	9	510.20
	2011	2	640.55	37	2,610.10
	2012	19	5,406.95	29	2,700.90
	2013	0	0.00	49	4,318.70
	2014	32	4,351.40	0	0.00
	2015*	16	2,791.3	12	1,818.50
<b>Carolina</b>	2012	20	5,117.80	0	0.00
	2013	52	12,459.20	0	0.00
<b>Cailloma 6</b>	2014	3	958.80	0	0.00
<b>Gaby</b>	2013	2	382.50	0	0.00
<b>San Carlos</b>	2014	2	495.80	0	0.00
<b>San Pedro</b>	2012	6	2,456.00	0	0.00
<b>Corona</b>	2012	1	344.60	0	0.00
<b>Lucia</b>	2012	0	0.00	8	1,300.20
<b>Toro</b>	2012	1	177.70	0	0.00
<b>Silvia &amp; Soledad</b>	2008	0	0.00	6	816.70
	2009	0	0.00	13	1,577.20
	2010	7	923.80	15	1,010.30
	2011	0	0.00	7	591.30
	2012	0	0.00	17	1,634.30
<b>Patricia</b>	2010	0	0.00	7	682.80
	2011	0	0.00	12	981.80
<b>Pilar</b>	2011	0	0.00	2	143.50
<b>San Antonio</b>	2011	2	391.50	0	0.00
<b>San Cristóbal &amp; Santa Catalina</b>	2006	3	551.00	10	480.55
	2007	0	0.00	8	850.60
	2008	0	0.00	4	700.10
	2011	4	1,396.15	4	527.80
<b>Nancy</b>	2006	1	86.60	0	0.00
	2007	6	1205.50	0	0.00
	2008	12	3,094.00	0	0.00
	2012	5	1,432.50	2	768.00
	2013	5	935.50	0	0.00
<b>Don Luis II</b>	2010	12	2,265.40	0	0.00
	2012	6	2,487.00	0	0.00
	2013	21	7,133.80	0	0.00
	2014	3	666.90	0	0.00
<b>Vilafro</b>	2010	2	304.30	0	0.00
<b>La Plata &amp; Cimoide La Plata</b>	2005	0	0.00	7	289.05
	2006	11	2,262.30	11	709.20
	2011	12	2,495.85	0	0.00



Vein	Year	Surface drilling		Underground drilling	
		Number	Meters	Number	Meters
Wendy	2012	0	0.00	4	1069.45
	2013	0	0.00	1	199.20
	2014	1	285.10	0	0.00
<b>Total</b>	<b>2005-15*</b>	<b>424</b>	<b>101,608.55</b>	<b>455</b>	<b>39,492.10</b>

\*thru June 30, 2015

Figure 10.1 Map showing surface drill hole collar locations



### Animas and Animas NE

In 2005, 94 drill holes totaling 2,028.00 meters were drilled from underground to evaluate the potential of the Animas structure at depth.

During 2006, 37 drill holes totaling 7,638.75 meters were drilled from surface and two from underground in order to determine the continuity of the Animas vein to a depth of approximately 4,450 masl. Exploration of the Animas NE vein was directed towards the 4,800 masl level and included nine drill holes, although only two holes intercepted any significant mineralization. Exploration drilling of the central Animas zone was focused between 4,700 masl (level 8) and 4,450 masl (level 13) and resulted in a number of significant intercepts. Drilling in the southwestern extension of the Animas vein included four drill holes.

In 2007, 32 drill holes totaling 8,770.35 meters were drilled in the Animas structure. The objective was to verify the structural continuity and mineral content both horizontally and vertically from 4,600 masl to 4,500 masl in the central Animas area.

In 2008 the Animas structure was further explored through drilling of ten diamond drill holes including three drill holes to level 10 (4,595 masl) and one to level 12 (4,500 masl), where the structure was characterized by the presence of quartz breccia and rhodonite, with a width of 4.7 meters and averaging 83 g/t Ag.

In 2010, a diamond drill program was designed to investigate the upper levels of the Animas vein between levels 5 (4,850 masl) and 6 (4,800 masl). Ten drill holes were completed resulting in the identification of high-grade silver mineralization in the upper portions of the Animas structure. Additional exploration drilling was also carried out in 2010 in the Animas Central area below 4,850 masl.

During 2011, twelve diamond drill holes totaling 3,411.10 meters were drilled from surface to investigate the Animas NE vein between 4,650 masl and 4,500 masl. Results were positive with the identification of a new ore shoot.

In 2012, 16 diamond drills totaling 4,275.80 meters were completed from surface in order to estimate the resource potential of the Animas NE ore shoot. Additionally, two diamond drills totaling 690.40 were completed from the surface to evaluate the potential depth of Animas SW ore shoot.

From underground, ten diamond drills totaling 2,649.40 meters were completed in 2012 to evaluate the continuity of the Animas vein to the elevation of 4,390 masl (level 14), thereby further testing the continuity of ore shoots 2 and 3. Additional drilling was carried out from underground drill stations to provide information for ore control purposes.

During 2013, 9 drill holes totaling 1,881.95 meters were drilled from underground for the purposes of upgrading of Animas NE Inferred Resources between the elevations of 4,450 masl and 4,350 masl.

During 2014, 9 drill holes totaling 1,858 meters were drilled from surface for purposes of upgrading of Animas NE Inferred Resources between the elevations of 4,700 masl and 4,550 masl. Among the significant results was that of drill hole ANIS027414 with 10.10 meters averaging 394 g/t Ag, 23.21% Pb and 4.06% Zn. In addition, 16 drill holes totaling 1,783.80 meters were drilled from underground drill stations for upgrading of Animas and Animas NE Inferred Resources.

In 2015, one drill hole totaling 72.10 meters was drilled for upgrading and conversion of Animas NE Inferred Resources.

#### Antimonio and Corona Antimonio

In 2006, a limited drill program was executed in the Antimonio and Corona Antimonio vein area with the drilling of five surface diamond drill holes totaling 1,117.50 meters.

#### Bateas

A diamond drill program involving eleven drill holes from surface was carried out to explore the Bateas vein in late 2007 and early 2008. The drilling confirmed the existence of a northeast striking vein structure characterized by the presence of high-grade silver mineralization with manganese gangue minerals such as rhodonite, rhodochrosite, and alabandite.

In 2011, two diamond drill holes totaling 640.55 meters were drilled from surface that successfully identified the continuity of the Bateas vein to the northeast with the most significant intercept being 1.6 meters of mineralization with grades averaging 220 g/t Ag and 0.33 g/t Au. In addition, 38 drill holes totaling 2,714.10 meters were completed from underground drill stations for ore definition and control purposes.

In 2012, 18 diamond drills totaling 5,006.65 meters were completed from the surface with the objective to evaluate the resource potential from the level 10 upwards to the surface.

During 2013, 49 drill holes totaling 4,318.70 meters were drilled from underground drill stations for purposes of upgrading of Inferred Resources between the elevations of 4,650 masl and 4,450 masl.

During 2014, 32 surface drill holes totaling 4,351.40 meters for purposes of upgrading of Inferred Resources between the elevations of 4,750 masl and 4,650 masl. Among the more significant intercepts was that of drill hole BATS016914 with 3,629 g/t Ag and 0.60 g/t Au over a width of 0.73 meters.

During 2015, 16 surface drill holes totaling 2,791.30 meters were drilled for upgrading of Inferred Resources in the Bateas and Bateas Ramal Piso veins between the elevations of 4,800 masl and 4,650 masl. An additional 12 drill holes totaling 1,818.50 meters were drilled from underground drill stations for purposes of upgrading of Inferred Resources between the elevations of 4,650 masl and 4,550 masl.

#### Cailloma 6

During 2014, three surface drill holes totaling 958.80 meters were drilled to test the mineralization potential of the Cailloma 6 Vein.

#### Carolina

In 2012, 20 diamond drills totaling 5,117.80 meters were completed from the surface for the purpose of evaluating the potential of the Carolina vein structure and to define the morphology of the mineralized ore shoot. The most important intercept was in drill hole CARS000512 with a 0.90 meter width averaging 152 g/t Ag and 8.85 g/t Au.

In 2013, 52 surface drill holes totaling 12,459.20 meters were completed to further define and upgrade the resources identified in the Carolina vein.

### Don Luis I & II

In mid-2010, seven diamond drill holes were drilled from surface to explore the Don Luis II vein. Positive results were achieved and the program was expanded to include five additional holes that were drilled prior to the end of 2010.

During 2012, six diamond drills totaling 2,487.00 m were completed from the surface to define the potential of this structure and to better understand the morphology of the mineralized ore shoot. The results were favorable with drill hole DLUS001612 reporting a 2.35 meter width averaging 459 g/t Ag and 0.42 g/t Au.

In 2013 and 2014, 24 additional surface drill holes totaling 7,800.70 meters were drilled to further define the resource potential of the Don Luis mineralized shoot.

### El Toro

During 2012, one diamond drill totaling 177.70 meters was completed from the surface for the purpose of exploring the potential of this vein to the east of the Cuchilladas creek. The results were favorable, intercepting 466 g/t Ag and 0.08 g/t Au over a width of 1.20 meters in drill hole TORS000112.

### La Plata and Cimoide La Plata

In 2005, seven drill holes were drilled from underground drill stations targeting the La Plata and Cimoide La Plata structures between the elevations of 4,745 masl (level 7) and 4,695 masl (level 8).

During 2006, eleven drill holes were drilled from surface to confirm the continuity at the extreme western portion of the La Plata vein, between the elevations of 4,700 masl and 4,550 masl. Results confirmed the continuity of the vein with grades between 20 g/t Ag and 100 g/t Ag and widths of 0.6 to 1.2 meters. Eleven diamond drill holes were also drilled from underground targeting the La Plata vein at a depth of 4,695 masl (level 8) to investigate the continuity of the ore shoot at depth.

In 2011, the La Plata drill program included twelve drill holes targeting elevations between 4,700 masl and 4,600 masl, with the most significant intercept returning grades of 260 g/t Ag and 5.74 g/t Au over a vein width of 1.90 meters.

In 2012 three diamond drill holes totaling 812.50 meters were executed from underground for the purpose of evaluating the continuity of the mineralized ore shoot at the 4,600 masl level. The best intercept was in drill hole LPLM003612 with 0.80 meters averaging 359 g/t Ag and 0.32 g/t Au.

In 2013, one drill hole totaling 199.20 meters was drilled from an underground drill station for the purposes of testing the mineralization at the 4,500 masl level.

### Lucia

In 2012, eight diamond drills totaling 1,300.20 meters were executed from underground drill stations for the purpose of evaluating the potential of this newly identified structure. The results were not favorable, identifying only low-grade polymetallic mineralization.

### Nancy

Exploration drilling from 2006 to 2007 included the drilling of seven diamond drill holes from surface totaling 1,292.10 meters. The drilling identified a structure consisting of a gray silica matrix and fragments of quartz with sulfides. In 2008, twelve drill holes

were drilled from surface totaling 3,094.00 meters and resulted in a number of important mineralized intercepts. In 2011, three drill holes designed to investigate the Animas NE vein also intercepted the Nancy vein providing further information on the continuity and grade of the vein.

During 2012, 5 diamond drill holes totaling 1,432.50 m were completed from the surface with the purpose of defining the resource potential of the Nancy vein.

During 2013, five surface diamond drill holes totaling 935.50 meters were completed for the purposes of further defining the resource potential of the Nancy vein. Significant results included drill hole NANS002713 averaging 116 g/t Ag, 17.89 g/t Au, 5.53% Pb and 7.06% Zn over a drill width of 5.01 meters.

#### Patricia

In 2010, exploration of the Patricia vein commenced from underground with the drilling of seven drill holes totaling 682.80 meters designed to investigate the vein structure at the 4,725 masl level.

In 2011, an additional twelve drill holes totaling 981.80 meters were completed from underground drill stations to evaluate the continuity of the Patricia vein and allow for a preliminary estimate of the identified mineral resources.

#### Pilar

In 2011, two exploration drill holes were completed from the underground workings of the San Cristóbal vein to investigate the possible continuity of the Pilar vein. Both drill holes intersected the Pilar structure, being approximately 1.0 meter in thickness and comprised of banded rhodochrosite, rhodonite, and quartz with veinlets of sphalerite, galena, chalcopryite, and pyrite.

#### San Antonio

Drilling of the San Antonio vein commenced in 2011 with the drilling of two drill holes from surface to investigate the potential of the vein. The vein thickness ranges from 0.7 to 6.0 meters with mineralization consisting of massive quartz, brecciated quartz, and boxwork quartz with infillings of limonite, quartz geodes displaying crustiform textures, pyrite and barite.

#### San Catalina

Exploration of the Santa Catalina vein by Minera Bateas commenced in 2006 with a drilling program from surface focused on investigating the mineral potential above and below level 8 (4,720 masl). In 2007, exploration continued through underground drilling to test the vein between level 8 (4,720 masl) and level 7 (4,773 masl) and resulted in the intersection of a narrow structure less than 5 meters wide composed of banded rhodonite-rhodochrosite with calcite and disseminated silver sulfosalts. Exploration drilling of the Santa Catalina vein also resulted in the discovery of additional polymetallic veins, such as Soledad, Silvia, Patricia, and Pilar.

#### San Cristobal

From 2006 to 2008, drilling was performed from surface and underground in order to explore the mineralization potential between level 11 (4,540 masl) and level 12 (4,500 masl). The drilling did not intersect any significant mineralization.



In 2011 a drilling campaign was conducted to test for the extension of the San Cristóbal vein to the northeast. Four drill holes totaling 1,396.15 meters were drilled from surface with three of the holes intersecting the vein structure but displaying limited mineralization. The fourth hole failed to intersect the vein. Field reconnaissance conducted post-drilling traced the projection of the San Cristóbal vein to the northeast and identified the structure on surface in the Cailloma 6 concession (Figure 9.1).

#### San Pedro

During 2012, six diamond drills totaling 2,456.00 meters were completed from the surface for the purpose of confirming reserves and to further explore the structure at depth. The results were not favorable, intercepting lower values than previously reported.

#### Silvia

In late 2007 and early 2008, a drilling program designed to investigate the Santa Catalina vein intersected the Silvia vein. Drill hole STCM000507 intercepted 0.60 meters of mineralization associated with the Silvia vein returning grades of 5.61% Pb, 4.94% Zn, 1.05% Cu, and 152 g/t Ag. Since 2008, underground development of the vein on level 7 (4,750 masl) has increased the understanding of the style of mineralization.

During 2009, 13 drill holes totaling 1,577.20 meters were drilled from underground drill stations to further test the mineral potential of the Silvia vein.

During 2010, 15 drill holes totaling 1,010.30 m were drilled from underground to investigate the ore shoot between 4,800 masl to 4,670 masl. Results proved the continuity of the ore shoot with the best result intercepting 2.07 meters of mineralization averaging 319 g/t Ag and 0.66 g/t Au.

Twenty-four drill holes totaling 2,225.60 meters were drilled from underground drill stations during 2011 and 2012 to further define the mineralization in the Silvia vein.

#### Soledad

In 2007, drilling designed to investigate the Santa Catalina vein also intersected the Soledad vein with one drill hole intercepting 1.30 meters of mineralization and returning high grades of silver (534 g/t), and gold (1.81 g/t). In late 2008, a drill campaign was conducted from underground to confirm the continuity of the structure to level 9 (4,650 masl).

In 2010, seven diamond drill holes totaling 923.8 meters were drilled from surface to explore the Soledad vein to a depth of approximately 4,800 masl. The drilling intersected the mineralized structure with the most significant intercept being a 1.3 meter interval averaging 135 g/t Ag and 0.62 g/t Au.

#### Vilafro

In 2010 two surface drill holes totaling 304.30 meters were completed in order to intersect fault structures associated with quartz veinlets and disseminated silver mineralization.

### 10.2.1 Drilling conducted post data cut-off date

As of the effective date of this report an additional 67 infill drill holes totaling 9,792.95 meters have been completed after the June 30, 2015 cut-off date. All of the drill holes were designed for purposes of upgrading of Inferred Resources of the Animas and Animas NE veins. Assay results for significantly mineralized intervals are summarized in



Table 10.3. As of the effective date of this report, assay results were pending for 13 of the 67 infill drill holes completed subsequent to the June 30, 2015 data cut-off date.

**Table 10.3 Significant infill drill results post the data cut-off date of June 30, 2015**

Hole_Id	From (m)	To (m)	Int (m)	Au (g/t)	Ag (g/t)	Pb (%)	Zn (%)	Cu (%)	Id_Vein*
ANIM028915	42.40	45.55	3.15	0.04	224	7.26	3.76	0.44	ASNE
ANIM029115	41.80	46.10	4.30	0.07	92	3.03	3.85	0.28	ASNE
ANIM029215	57.20	60.30	3.10	0.14	223	3.54	4.87	0.42	ASNE
ANIM029415	52.30	57.00	4.70	0.78	43	0.73	5.36	0.25	ASNE
ANIM029515	49.80	50.95	1.15	0.08	20	1.23	3.98	0.10	ASNE
	56.50	67.40	10.90	0.13	29	1.44	7.06	0.15	RT_ASNE
ANIM029715	52.30	58.95	6.65	0.08	77	1.74	1.52	0.26	ASNE
	65.00	78.20	13.20	0.15	42	2.05	9.10	0.27	RT_ASNE
ANIM029915	33.60	37.40	3.80	0.11	172	10.59	11.24	0.60	ASNE
ANIM030015	43.95	44.80	0.85	0.09	33	1.92	1.74	0.11	ASNE
ANIM030215	68.40	75.30	6.90	0.22	38	0.49	2.66	0.23	ASNE
ANIM030315	74.00	74.80	0.80	0.20	132	5.22	9.12	1.04	ASNE
ANIM030515	93.10	95.05	1.95	0.25	205	4.97	3.44	0.39	ASNE
ANIM030715	75.15	76.30	1.15	0.24	35	2.38	2.52	0.03	ASNE
ANIM030815	133.10	134.40	1.30	0.03	58	0.91	6.36	0.26	ASNE
ANIM031015	74.95	76.00	1.05	0.25	76	1.60	3.26	0.22	ASNE
ANIM031215	78.10	79.40	1.30	0.30	39	1.97	5.55	0.13	ASNE
ANIM034416	88.50	89.40	0.90	0.06	70	4.80	5.19	0.27	ASNE
	152.95	155.50	2.55	0.08	124	9.54	8.55	0.27	RT_ASNE
ANIM034616	59.10	60.30	1.20	0.08	53	2.45	3.99	0.20	ASNE
	78.55	79.20	0.65	0.07	93	6.69	10.55	0.23	RT_ASNE
ANIM034816	98.80	99.15	0.35	0.16	104	4.23	7.15	0.74	RT_ASNE
ANIM034916	87.90	91.20	3.30	0.05	64	3.03	0.77	0.36	ASNE
	163.05	166.50	3.45	0.18	28	1.64	1.21	0.13	RT_ASNE
ANIM035116	No significant mineralized intervals								
ANIM035416	68.25	69.05	0.80	0.16	104	6.94	11.10	0.48	ASNE
ANIM035616	39.00	39.75	0.75	0.11	71	3.95	7.50	0.24	ASNE
	78.30	78.80	0.50	0.42	87	3.31	5.07	0.62	RT_ASNE
ANIM035816	162.05	162.60	0.55	0.11	34	2.60	6.56	0.12	RT_ASNE
ANIM035916	140.55	145.50	4.95	0.28	34	1.24	9.87	0.19	AS
ANIM036116	90.50	92.35	1.85	0.04	26	1.39	2.90	0.13	ASNE
	178.05	180.00	1.95	0.06	79	7.17	15.14	0.13	RT_ASNE
ANIM036416	144.35	147.00	2.65	0.20	58	2.71	17.16	0.27	AS
ANIM036616	60.35	63.60	3.25	0.08	365	5.62	1.49	0.69	ASNE
ANIM036716	131.00	133.80	2.80	0.06	98	3.06	5.53	0.06	AS
ANIM036916	77.50	79.90	2.40	0.08	129	6.67	16.25	0.71	ASNE
ANIM037016	155.65	161.65	6.00	0.17	24	0.76	6.45	0.15	ASNE
ANIM037216	79.30	81.30	2.00	0.12	73	2.14	6.21	0.66	ASNE
ANIM037416	171.25	173.70	2.45	0.16	23	0.54	8.06	0.11	AS
ANIM037516	84.00	86.60	2.60	0.17	91	4.15	16.71	0.33	ASNE
ANIM037616	87.90	88.80	0.90	0.15	61	2.97	9.06	0.26	ASNE
ANIM037716	171.00	172.60	1.60	0.19	71	3.87	7.45	0.08	AS
ANIM038216	No significant mineralized intervals								



Hole_Id	From (m)	To (m)	Int (m)	Au (g/t)	Ag (g/t)	Pb (%)	Zn (%)	Cu (%)	Id_Vein*
ANIS028215	174.05	178.30	4.25	0.34	148	6.43	8.02	0.44	ASNE
ANIS028415	191.80	198.40	6.60	0.15	128	2.45	3.56	0.39	ASNE
ANIS028715	198.85	208.60	9.75	0.25	104	1.73	0.32	0.15	ASNE
ANIS031515	241.00	241.85	0.85	0.09	61	1.70	6.09	0.33	RT_ASNE
ANIS031815	253.60	255.80	2.20	0.16	66	3.54	5.08	0.21	ASNE
	216.20	216.95	0.75	0.11	110	5.29	3.99	0.45	RT_ASNE
ANIS032215	244.90	247.40	2.50	0.54	69	2.57	7.18	0.34	ASNE
	207.35	208.60	1.25	0.51	98	3.73	10.36	0.63	RT_ASNE
ANIS032515	176.50	178.90	2.40	1.76	178	7.58	8.71	0.39	ASNE
ANIS032615	187.75	193.15	5.40	0.31	156	6.26	6.37	0.43	ASNE
ANIS032815	210.40	215.05	4.65	0.39	167	3.61	0.23	0.19	ASNE
ANIS033116	192.65	195.90	3.25	0.38	86	3.80	4.33	0.39	ASNE
ANIS033416	132.00	138.70	6.70	1.65	162	3.53	0.55	0.22	ASNE
ANIS033516	125.90	132.70	6.80	0.66	185	3.53	0.27	0.21	ASNE
ANIS033716	121.40	122.25	0.85	2.55	215	1.63	0.17	0.12	ASNE
ANIS033916	132.25	133.40	1.15	0.43	63	1.47	3.41	0.23	ASNE
ANIS034016	129.05	131.20	2.15	0.91	89	1.98	0.25	0.05	ASNE
ANIS034116	121.65	126.90	5.25	0.14	103	1.84	0.43	0.27	ASNE

\*AS = Animas vein; ASNE = Animas Northeast vein; RT\_ASNE = Ramal Techo Animas Northeast vein

An updated resource and reserve evaluation process was in-progress as of the effective date of this report that will incorporate the new drilling results into the block model and provide an update on the mineral resources and reserves as of year-end 2016.

### 10.3 Diamond drilling methods

Minera Bateas has used a number of different drilling contractors to carry out exploration and definition drilling since it took ownership of the property in 2005. During 2012, drilling was conducted by two drilling contractors, Geodrill and Explomin. Multiple drill rigs were used during the campaign, including two Longyear 44s, two Geo-3000, and one TEC DRILL H-200 for underground drilling. Both HQ (63.5 mm) and NQ (47.6 mm) diameter core were obtained, depending on the depth of the hole. From 2013 through the end of June of 2015, the exploration and resource definition drilling was carried out by drilling contractor Geodrill as well as by Minera Bateas-owned drill rigs.

Proposed surface drill hole collar coordinates, azimuths and inclinations were designed based on the known orientation of the veins and the planned depth of vein intersection using geological plan maps and sections as a guide.

The drilling platform, together with its access road and sedimentation pit, were prepared using a D7 tractor. The dimensions of the drilling platform are clearly marked in advance of construction with flags indicating the limits for earth movement in order to minimize soil disturbance and comply with government directive D.S. N° 020-2008-EM regarding Environmental Regulations for Exploration Activities.

Drill core is stored in waterproof cardboard boxes with each box storing up to 3.0 meters of core. Prior to transportation, core boxes are verified to ensure correct, consecutive labeling, as well as clear and legible drill hole codes. The inside of the box is checked for a direction arrow indicating the start and end of the core sequence. The lid

of the core box is labeled to clearly show the accrued length and each side of the lid details the previous accrued length ("From"), and current accrued length ("To").

Drill core boxes are only handled and transported by personnel appointed to this task. Boxes are checked and secured prior to transportation to minimize the risk of shifting or mixing of core samples during transportation. Care is taken to ensure that core boxes arrive at the logging facilities with minimal disturbance to the core or the depth markers.

In the logging facilities, geologists and geotechnical technicians carry out geotechnical measurements, logging and sampling of mineralized core. Core is first examined to capture geological information. Initially, quick logging is performed to prepare a brief description of the mineralization intersects. The logging sheet allows the recording of essential information in the form of both graphics and written descriptions. A photographic record of the core is taken using a digital camera.

## 10.4 Drill core recovery

Sample recovery for each drill interval is recorded by geotechnical technicians. Drill core recovery is generally good, on average greater than 90 percent. Recoveries can be lower near surface or when fault structures are encountered due to the more fragmented nature of the core. Recovery is generally excellent through the mineralized vein structures. The core recovery values are used when considering the reliability of the sample for resource estimation purposes. The presence of bias due to core loss is detected by performing a correlation analysis on recovery and grade.

## 10.5 Extent of drilling

Drill holes are typically drilled on sections spaced 40 to 60 meters apart along the strike of the vein with surface drilling focusing on exploring the extents of the Animas, Bateas and Nancy veins and underground drilling used for a mix of exploration and resource and reserve definition. The extent of drilling varies for each vein with those having the greatest coverage having drill holes extending over 4,000 meters of the vein's strike length (Animas), to the least having only a couple of drill holes extending over 50 meters (Antimonio).

## 10.6 Drill hole collar surveys

The coordinates for the proposed drill hole collar location are determined through assessing the azimuth and inclination of the proposed drill hole to achieve the desired depth of intercept in cross sections. Once the coordinates have been determined, the location of the collar is located in the field using differential GPS. The drilling pad is then prepared at this marked location. Upon completion of the drill hole, a survey of the collar is performed using Total Station equipment, with results reported in the collar coordinates using reference Datum WGS84, UTM Zone 19S.

## 10.7 Downhole surveys

The geologist in charge of drilling is responsible for orienting the azimuth and inclination of the hole at the collar using a compass clinometer. Downhole surveys are completed by the drilling contractor using survey equipment such as a Flexit or Reflex tool at approximately 50 meter intervals for all surface drill holes and for underground

drill holes greater than 100 meters in length. Minera Bateas assesses the downhole survey measurements as a component of the data validation.

Drill holes recovered from CMA do not include downhole survey information and drill hole azimuths and inclinations recorded at the collar have been used to project the hole to its full depth.

## 10.8 Drill Sections

Representative drill sections displaying the geologic interpretation of the Animas Vein are displayed in Figures 10.3 and 10.4. A plan view showing the location of the sections is provided in Figure 10.2.



Figure 10.2 Plan map showing orientation of geologic sections

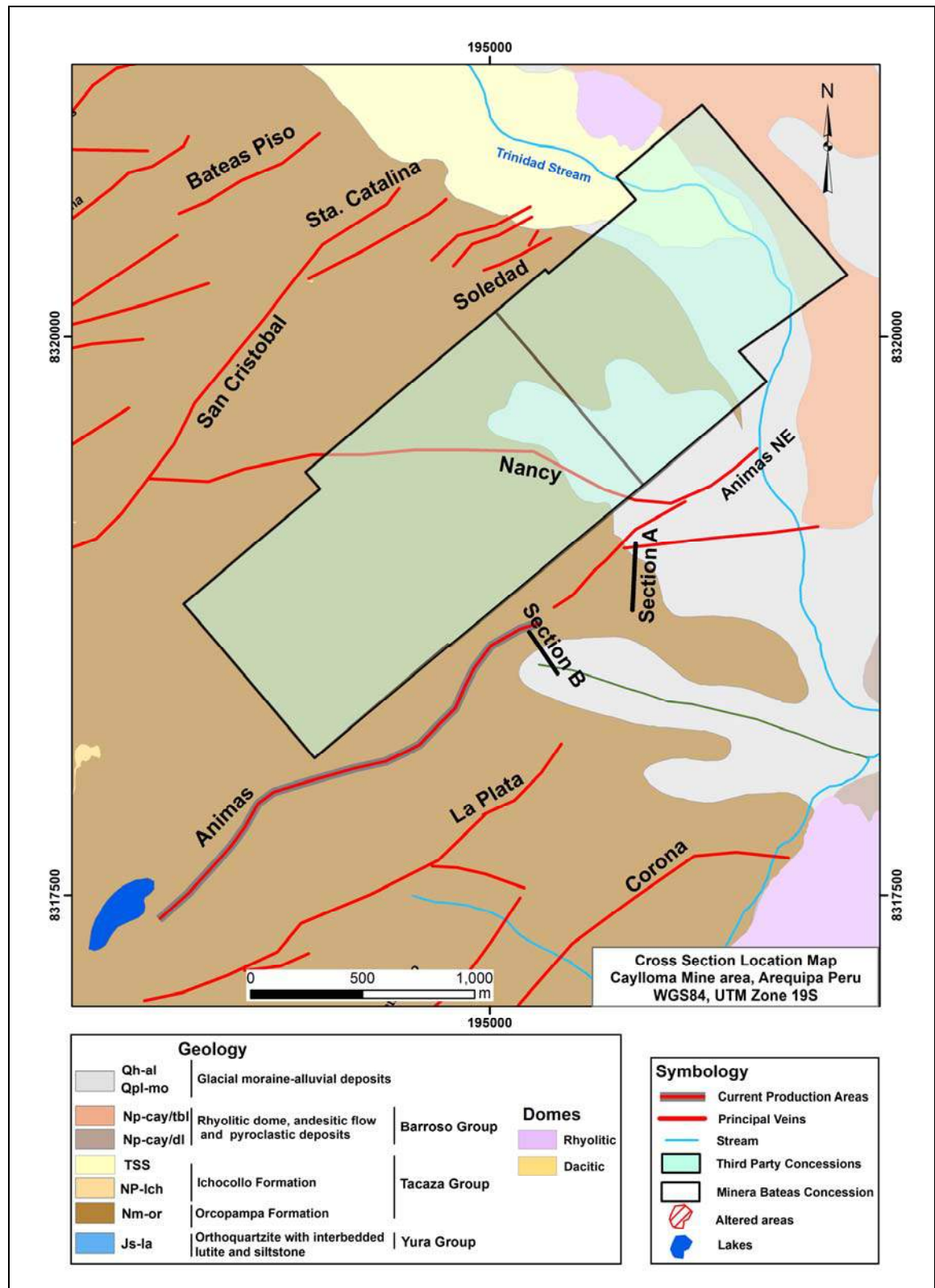
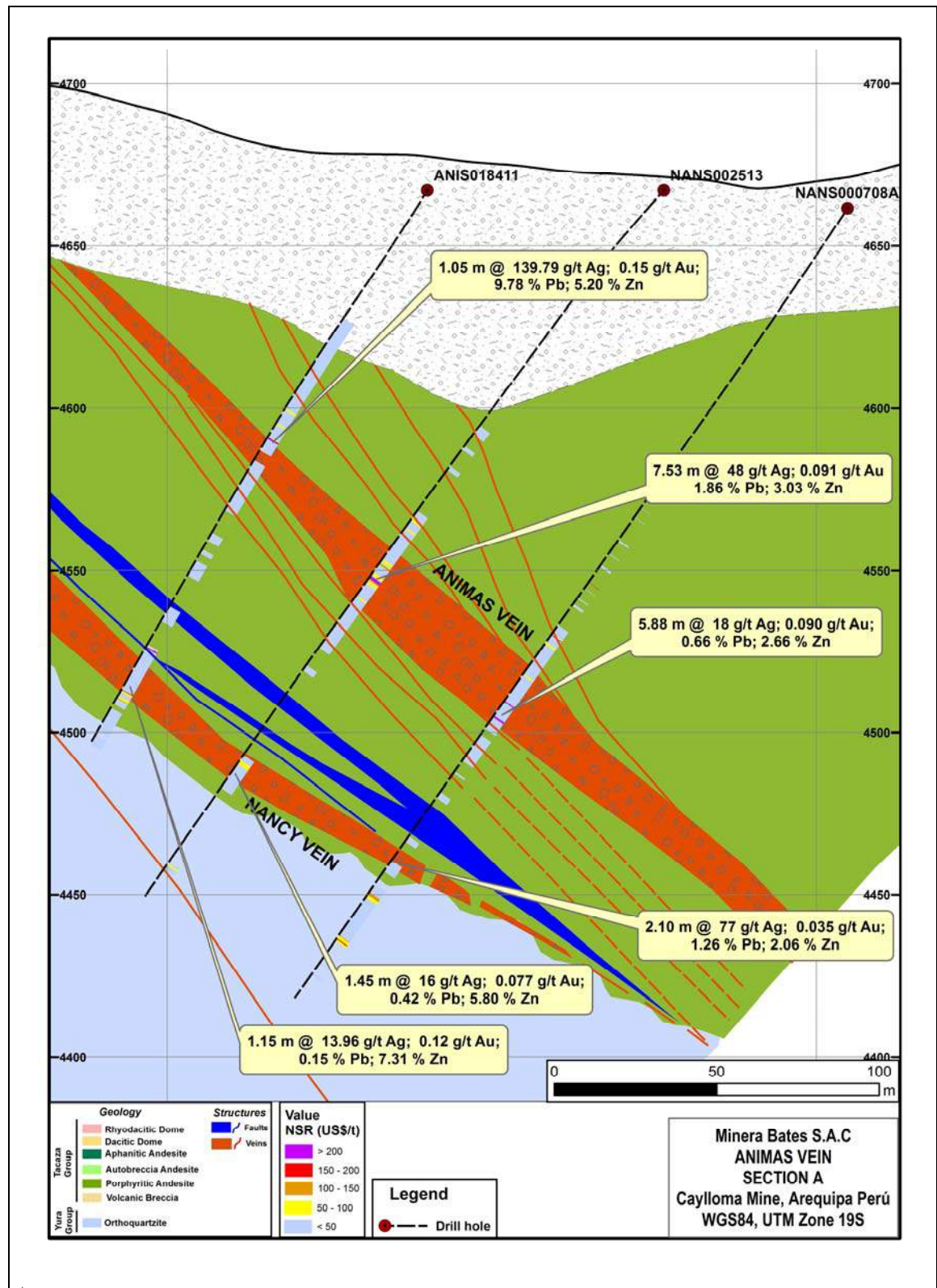




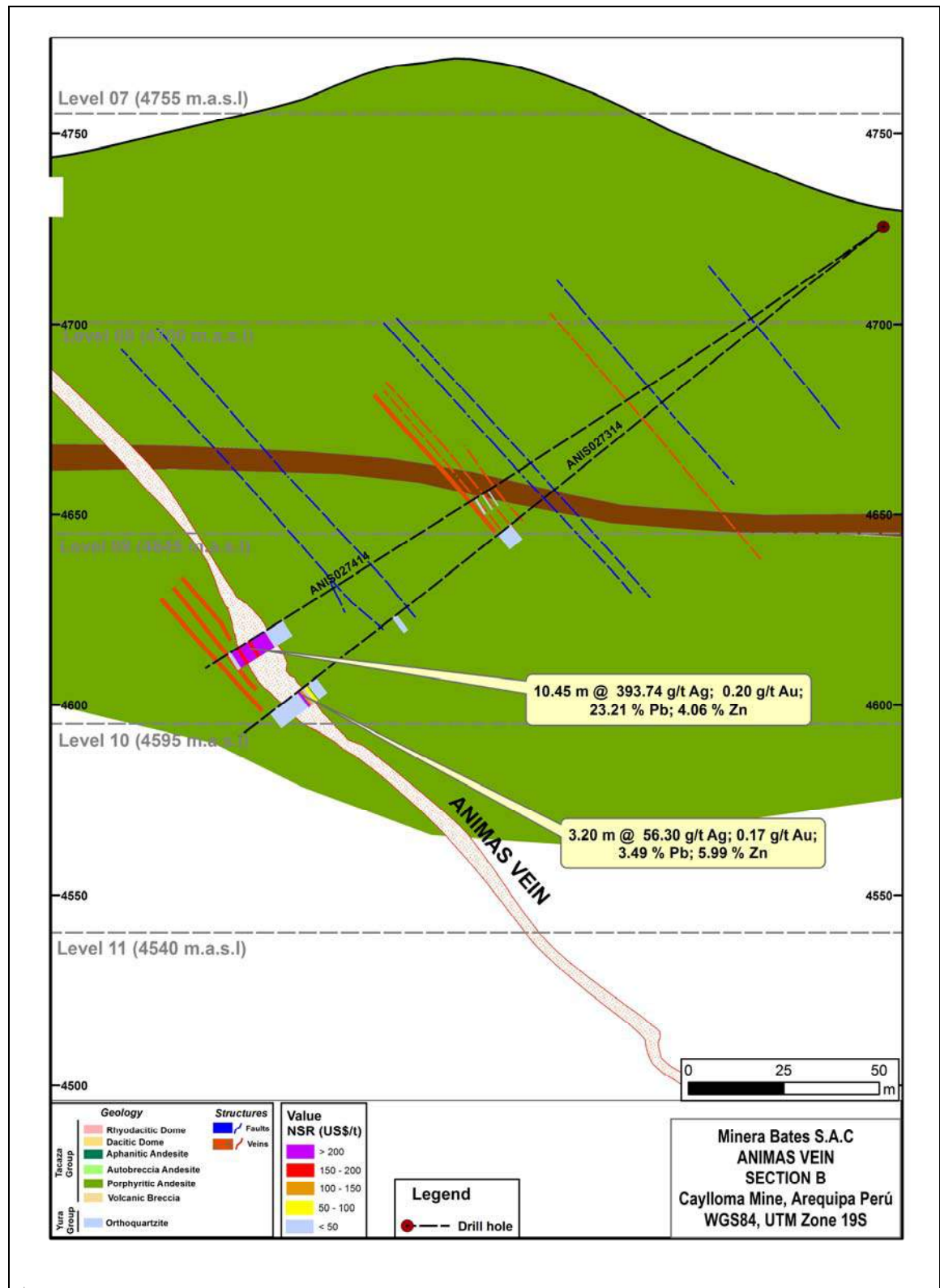


Figure 10.3 Geologic interpretation of Animas vein (Section A)





**Figure 10.4 Geologic interpretation of Animas vein (Section B)**





## 11 Sample Preparation, Analyses, and Security

All samples at Caylloma are collected by geological staff of Minera Bateas with sample preparation and analysis being conducted either at the onsite Bateas laboratory (channel samples and underground development drill core) or the ALS Chemex laboratory in Lima (exploration drill core). The Bateas on-site laboratory is not a certified laboratory. Therefore, pulp splits and preparation duplicates, along with reference standards and blanks are routinely sent to the ISO certified ALS Chemex laboratory in Lima to monitor the performance of the Bateas laboratory.

### 11.1 Sample preparation prior to dispatch of samples

#### 11.1.1 Channel chip sampling

Channel samples are collected from the backs of underground workings. The entire process is carried out under the geology department's supervision.

Since February 2011 the location of each channel has been surveyed using Total Station equipment. Surveyors use an underground survey reference point to locate the starting coordinates of each channel. Prior to February 2011, this process was performed by compass and tape measure.

Sampling is carried out at 2 m intervals within the drifts of all veins and 3 m intervals in stopes (except for Bateas and Soledad, where due to the thickness of the vein sampling is carried out every 2 m in stopes). The channels length and orientation are identified using paint in the underground working and by painting the channel number on the footwall. The channel is between 20 cm to 30 cm wide and approximately 2 cm deep, with each individual sample being no longer than 1.5 m.

The area to be sampled is washed down to provide a clean view of the vein. The channel is sampled by taking a succession of chips in sequence from the hanging wall to the footwall perpendicular to the vein based on the geology and mineralization.

Samples, comprised of fragments, chips and mineral dust, are extracted using a pick and hammer, along the channel's length on a proportional basis. Proper marking of the channel is critical to ensuring that the proportions taken are representative.

For veins with narrow or reduced thickness ( $<0.20$  m), the channel width is expanded to 0.40 m, thus providing the opportunity to obtain the necessary sample mass.

Sample collection is normally performed by two samplers, one using the hammer and pick, and the other holds the receptacle (cradle), to collect rock and ore fragments. Usually the cradle consists of a sack, with the mouth kept open by a wire ring. Based on an evaluation of the Fundamental Sampling Error (FSE) and the equipment available in the Bateas laboratory a sample mass of between 3 kg and 6 kg is generally collected.

Since August 2012 the entire sample is placed in a plastic sample bag with a sampling card and assigned sample ID and taken to the laboratory for homogenization and splitting.

Prior to August 2012, samples were prepared prior to being bagged using a cone and quarter methodology. The process involved homogenizing the sample by overturning the sample numerous times within a plastic sampling sheet, while taking care not to lose any material. Once the sample had been homogenized it was divided into four equal

quarters and a representative sample collected from opposite quarters, diagonally (the other two quarters are discarded). Splitting could be performed more than once to ensure a sample no heavier than 2.5 kg to 3 kg was collected, corresponding to a full sampling bag. The obtained sample was then deposited in a plastic sample bag with a sampling card and assigned sample ID. The cone and quarter methodology was regarded as being inappropriate for sample splitting so the procedure was halted.

#### 11.1.2 Core sampling

A geologist is responsible for determining and marking the intervals to be sampled, selecting them based on geological and structural logging. The sample length must not exceed 1 m or be less than 10 cm.

Splitting of the core is performed by diamond saw. The geologist carefully determines the line of cutting, in such a way that both halves of the core are representative. The core cutting process is performed in a separate building adjacent to the core logging facilities. Water used to cool the saw is not re-circulated but stored in drums to allow any fines to settle before final disposal.

Once the core has been split, half the sample is placed in a sample bag. A sampling card with the appropriate information is inserted with the core.

#### 11.1.3 Bulk density determination

Samples for density analysis are collected underground using a hammer and chisel to obtain a single large sample of approximately six kilograms. The sample is always taken of mineralized material in the same locality as a channel sample. The coordinates of the closest channel sample are assigned to the density sample. The sample is brought to the surface and delivered to the core cutting shed where each side of the sample is cut using a diamond saw to produce a smooth sided cube. The sample is labeled and bagged prior to being stored in the storage facilities to await transportation with other samples to the ALS Chemex laboratory in Arequipa.

Density tests are performed at the ALS Chemex laboratory in Lima using the OA-GRA09A methodology. This test consists of firstly cutting, weighing (maximum of 6 kg) and coating the sample in paraffin wax. Samples are then slowly placed into the bulk density apparatus which is filled with water. The displaced water is collected into a graduated cylinder and measured. The bulk density calculations are corrected for air temperature and the density of the wax coating.

### 11.2 Dispatch of samples, sample preparation, assaying and analytical procedures

#### 11.2.1 Sample dispatch

Once samples have been collected they are assigned a batch number and either submitted to the Minera Bateas onsite laboratory, or sent to the mine warehouse to await transportation (three times a week) to the ALS Chemex facility in Arequipa, and then on to the ALS Chemex laboratory in Lima for analysis.

The primary laboratory (Bateas) uses the same sample preparation, assaying and analytical procedures as are performed at the umpire laboratory (ALS Chemex).

### 11.2.2 Sample preparation

Upon receipt of a sample batch the laboratory staff immediately verifies that sample bags are sealed and undamaged. Sample numbers and ID's are checked to ensure they match that as detailed in the submittal form provided by the geology department. If any damaged, missing, or extra samples are detected the sample batch is rejected and the geology department is contacted to investigate the discrepancy. If the sample batch is accepted the samples are sequentially coded and registered as received.

Accepted samples are then transferred to individual stainless steel trays with their corresponding sample ID's for drying. The trays are placed in the oven for two to four hours at a temperature of 110°C.

Once samples have been dried they are transferred to a separate ventilated room for crushing using a two stage process. Firstly, the sample is fed into a terminator crusher to reduce the original particle size so that approximately 90 percent passes ½ inch mesh sieve size. The entire sample is then fed to the secondary Rhino crusher so that the particle size is reduced to approximately 85 percent passing a 10 mesh sieve size. The percent passing is monitored daily to ensure these specifications are maintained. The crushing equipment is cleaned using compressed air and a barren quartz flush after each sample.

Once the sampling has been crushed it is reduced in size to 150 g  $\pm$  20 g using a single tier Jones riffle splitter. The reduced sample is returned to the sampling tray for pulverizing whereas the coarse reject material is returned to a labeled sample bag and temporarily placed in a separate storage room for transferal to the long term storage facilities located adjacent to the core logging facilities.

Crushed samples are pulverized using a Rocklab standard ring mill so that 90 percent of particles pass a 200 mesh sieve size. The pulp sample is carefully placed in an envelope along with the sample ID label. Envelopes are taken to the balance room where they are checked to ensure the samples registered as having being received and processed match those provided in the envelopes.

The Minera Bateas laboratory's preparation facilities have been inspected by Mr. Eric Chapman on various occasions and found to be clean and well organized. All weighing equipment is calibrated on a daily basis using in-house weights and externally calibrated once a year.

### 11.2.3 Assaying of silver, lead, copper and zinc

Upon receipt of samples in the analytical laboratory, all pulps are re-checked to ensure they match the list in the submittal form. Once completed, 0.5 g of the pulp is weighed and transferred into a 250 ml Teflon container. Added to this is 5 ml of HNO<sub>3</sub>, 5 ml of HCl, 1 ml HF, and 1 ml of perchloric acid and the solution is placed in a small oven at 150°C to 200°C until the mixture becomes pasty in consistency. The paste is cooled before 25 % HCl is added to the container. This mixture is then boiled until it changes color. The solution is then transferred to a new vial, cooled and diluted with distilled water before being analyzed.

The elements of silver, copper, lead and zinc are assayed using atomic absorption techniques. An initial and duplicate reading is taken and an internal standard is inserted every ten samples to monitor and calibrate the equipment.

#### 11.2.4 Assaying of gold

After checking that the pulps match the submittal form, 30 g of the pulp is weighed and added to a crucible, along with 120 g of flux, and 1 g to 5 g of  $\text{KNO}_3$  if it is a sulfide sample or 1.5 g to 2.0 g of flour if it is an oxide sample. The material is carefully homogenized before being covered by a thin layer of borax.

The mixture is placed in an oven for approximately one to two hours and heated to  $1,150^\circ\text{C} \pm 50^\circ\text{C}$ . Once the crucibles have cooled the slag material is separated and discarded with the remaining material being transferred to a ceramic cup and placed in an oven for 45 to 60 minutes at a temperature of between  $950^\circ\text{C}$  to  $1,050^\circ\text{C}$  in order to evaporate any lead and leave behind a clean doré (Ag/Au).

The doré is carefully transferred to a test tube and 1 ml of 15 % nitric acid is added before it is transferred to an oven and heated to  $200^\circ\text{C} \pm 20^\circ\text{C}$  and monitored until digestion is complete. The sample tubes are removed from the oven, cooled for five minutes before 2.5 ml of hydrochloric acid is added. The solution is heated once again until a pale yellow solution is observed marking the end of the reaction and cooled once more for five minutes before 1 ml of 2 % aluminum nitrate. Distilled water is then added to the test tube to ensure the volume of solution is 5 ml, before it is covered and agitated. The test tubes are left to stand to allow sedimentation prior to analysis by atomic absorption.

### 11.3 Sample security and chain of custody

Sample collection and transportation of both drill hole and channel samples is the responsibility of the geology department.

Core boxes are sealed and carefully transported to the core logging facility constructed in 2012 where there is sufficient room to layout and examine several holes at a time. The core logging facility is located at the mine site and is locked when not in use.

Once logging and sampling have been performed, the remaining core is transferred to the core storage facilities located adjacent to the logging facilities. The storage facilities consist of a secure warehouse constructed in 2011 to replace the older facilities that were located a kilometer to the north of the mine camp. The warehouse is dry and well illuminated, with metal shelving with sufficient capacity to store all historical drill core and plenty of space for the coming years.

The core is stored chronologically and location plans of the warehouse provide easy access to all core collected by Minera Bateas. The storage facility is managed by the Brownfields Exploration Manager and the Superintendent of Geology and any removal of material must receive their approval.

Coarse reject material for drill core, channel and exploration samples are collected from the Minera Bateas laboratory every ten days and stored in a storage facility adjacent to the core storage facility. Storage of the core and exploration coarse rejects is the responsibility of the Brownfields Exploration Manager. Storage of the channel sample rejects is the responsibility of the resource modeling department. All drill core rejects are presently retained indefinitely. Channel reject material is stored between three and twelve months depending on the sample location.

Pulps for drill core, channel and exploration samples are returned to the originator for storage in a separate building adjacent to the Bateas laboratory. It is the responsibility of the originator to ensure these samples are stored in an organized and secure fashion.

Samples are retained in accordance with the Fortuna corporate sample retention policy. All exploration drill core, coarse rejects, and pulps are stored for the life of mine. All underground drill core and pulps obtained during underground sampling are retained for the life of mine. Disposal of surface and underground channel coarse reject samples is performed after 90 days and is the responsibility of the Geology Superintendent.

## 11.4 Quality control measures

The routine insertion of certified reference material, blanks, and duplicates with sample submissions as part of a sample assay quality assurance/quality control (QAQC) program is current industry best practice. Analysis of QAQC data is performed monthly at the operation to assess the reliability of sample assay data and the confidence in the data used for estimation.

Minera Bateas routinely inserts certified standards, blanks, and field duplicates to the Minera Bateas laboratory and regularly sends preparation (coarse reject), and pulp duplicates along with standards and blanks to the umpire ALS Chemex laboratory.

Previous technical reports (CAM, 2006; CAM, 2009; Chapman and Vilela, 2012; Chapman and Kelly, 2013) have assessed the QAQC results of CMA and Minera Bateas and reported them as acceptable. A full evaluation of all available QC results has been conducted by Fortuna as a component of the resource estimation process. An assessment was performed on all QC samples submitted to the Cuzcatlan laboratory (responsible for preparation and assaying of underground channel samples and development drill core) and the ALS Chemex laboratory (responsible for preparation and assaying of exploration drill core) up to the June 30, 2015 data cut-off date.

### 11.4.1 Standard reference material

Certified reference material (SRM) are samples that are used to measure the accuracy of analytical processes and are composed of material that has been thoroughly analyzed to accurately determine its grade within known error limits. SRMs are inserted by the geologist into the sample stream, and the expected value is concealed from the laboratory, even though the laboratory will inevitably know that the sample is a SRM of some sort. By comparing the results of a laboratory's analysis of a SRM to its certified value, the accuracy of the result is monitored.

SRMs, or standards, whose true values are determined by a laboratory, have been placed into the sample stream by Minera Bateas geologists to ensure sample accuracy throughout the sampling process. SRM results detailed in this Technical Report are presented in a tabular form; however, results are assessed at the operation on a monthly basis using time series graphs to identify trends or biases.

#### **Bateas Laboratory**

This analysis focuses on the submission of 8,093 standards submitted with 183,694 channel samples as of June 30, 2015 to the Bateas laboratory which represents a submission rate of 1 in 23 samples. As described above the Bateas laboratory employs a four acid digestion methodology with atomic absorption (AA) for assaying silver, lead and zinc, unless the grade is greater than 1,500 g/t for silver, or 13 % for lead, or 13 % for zinc. If the silver grade was found to be greater than 1,500 g/t it was re-assayed by fire assay using a gravimetric finish (FA-GRAV). If the lead or zinc grades were found to be higher than their upper limits they were re-assayed by volumetric methods (VOL). For gold, the sample is assayed using fire assay with atomic absorption finish (FA-AA) unless the gold grade is greater than 5 g/t Au, in which case the sample is re-assayed



with a gravimetric finish (FA-GRAV). The grade characteristics of the different SRMs used at the Minera Bateas laboratory are detailed in Table 11.1.

**Table 11.1 Accepted values for standards inserted at Bateas laboratory**

Standard	Silver (g/t)		Lead (%)		Zinc (%)		Gold (g/t)	
	Value	SD	Value	SD	Value	SD	Value	SD
AGA-03	480	10.0	1.636	0.042	2.533	0.053	1.384	0.049
AGB-01	59.1	1.75	0.628	0.019	0.830	0.023	0.359	0.014
AGM-02	183	3.80	1.352	0.028	1.632	0.043	0.439	0.027
CDN-FCM-2	73.9	3.65	0.479	0.019	1.739	0.052	1.370	0.060
CDN-FCM-3	23.6	1.65	0.152	0.007	0.543	0.016	0.400	0.035
CDN-FCM-6	156.8	3.95	1.520	0.030	9.270	0.220	2.150	0.080
CDN-FCM-7	64.7	2.05	0.629	0.021	3.850	0.095	0.896	0.042
CDN-HC-2	15.3	0.70	0.476	0.018	0.259	0.007	1.670	0.060
CDN-HLHC	111	4.30	0.170	0.005	2.350	0.055	1.970	0.110
CDN-HLHZ	101.2	5.40	0.815	0.030	7.660	0.180	1.310	0.080
CDN-HLLC	65.1	3.35	0.290	0.015	3.010	0.085	0.830	0.060
CDN-HZ-2	61.1	2.05	1.620	0.055	7.200	0.175	0.124	0.012
CDN-HZ-3	27.3	1.60	0.707	0.018	3.160	0.080	0.055	0.005
CDN-ME-1	39.3	2.30	0.324	0.010	0.347	0.014	0.870	0.045
CDN-ME-2	14	0.65	-	-	1.350	0.050	2.100	0.055
CDN-ME-3	275	8.10	2.820	0.060	0.880	0.030	9.970	0.290
CDN-ME-4	414	8.50	4.250	0.120	1.100	0.030	2.610	0.150
CDN-ME-5	205.6	4.65	2.130	0.060	0.579	0.010	1.070	0.070
CDN-ME-6	101	3.55	1.020	0.040	0.517	0.020	0.270	0.014
CDN-ME-7	150.7	4.35	4.950	0.150	4.840	0.085	0.219	0.012
CDN-ME-8	61.7	2.35	1.940	0.040	1.920	0.040	0.093	0.009
CDN-ME-11	79.3	3.00	0.860	0.050	0.960	0.030	1.380	0.050
CDN-ME-16	30.8	1.10	0.879	0.020	0.807	0.020	1.480	0.070
CDN-ME-19	103	3.50	0.980	0.030	0.750	0.020	0.620	0.039
CDN-ME-1206	274	7.00	0.801	0.022	2.380	0.075	2.610	0.100
CDN-ME-1302	418.9	8.15	4.680	0.120	1.200	0.020	2.412	0.117
CDN-ME-1306	104	3.50	1.600	0.135	3.170	0.075	0.919	0.056
CDN-SE-1	712	28.5	1.920	0.045	2.650	0.100	0.480	0.017
CDN-SE-2	354	10.5	0.957	0.022	1.340	0.055	0.242	0.009
PB111	195	5.72	2.120	0.036	0.450	0.019	-	-
PB114	26	1.42	2.000	0.055	1.120	0.033	-	-
PLA-03	186	4.40	4.906	0.137	5.343	0.092	0.396	0.018
PLB-01	28.7	1.30	0.612	0.016	0.910	0.022	0.108	0.006
PLM-02	87.4	1.90	1.233	0.027	2.157	0.045	0.225	0.008

The results for blind SRM's inserted by the geology department to the Bateas laboratory are displayed in Table 11.2.



**Table 11.2 Results for SRM's submitted to the Bateas laboratory**

Standard	Silver			Lead			Zinc			Gold		
	No. inserted	No. fails*	Pass rate (%)	No. inserted	No. fails*	Pass rate (%)	No. inserted	No. fails*	Pass rate (%)	No. inserted	No. fails*	Pass rate (%)
AGA-03	361	0	100	361	0	100	361	0	100	361	4	98.9
AGB-01	152	0	100	152	0	100	152	0	100	152	1	99.3
AGM-02	344	0	100	344	0	100	344	0	100	344	0	100
CDN-FCM-2	119	1	99.2	119	1	99.2	119	1	99.2	119	1	99.2
CDN-FCM-3	178	1	99.4	178	3	98.3	178	10	94.4	178	2	98.9
CDN-FCM-6	152	1	99.3	152	1	99.3	152	1	99.3	152	2	98.7
CDN-FCM-7	109	0	100	109	0	100	109	0	100	109	1	99.1
CDN-HC-2	449	0	100	449	0	100	449	0	100	449	0	100
CDN-HLHC	175	0	100	175	4	97.7	175	1	99.4	175	1	99.4
CDN-HLHZ	114	0	100	114	0	100	114	1	99.1	114	0	100
CDN-HLLC	120	0	100	120	0	100	120	0	100	120	0	100
CDN-HZ-2	245	0	100	245	0	100	245	0	100	245	0	100
CDN-HZ-3	672	0	100	672	0	100	672	0	100	672	1	99.9
CDN-ME-1	139	0	100	139	0	100	139	0	100	139	0	100
CDN-ME-2	348	0	100	-	-	-	348	0	100	348	1	99.7
CDN-ME-3	147	0	100	147	0	100	147	0	100	147	0	100
CDN-ME-4	197	2	99.0	197	2	99.0	197	2	99.0	197	2	99.0
CDN-ME-5	597	0	100	597	0	100	597	1	99.8	597	2	99.7
CDN-ME-6	371	0	100	371	0	100	371	0	100	371	1	99.7
CDN-ME-7	252	2	99.2	252	2	99.2	252	2	99.2	252	2	99.2
CDN-ME-8	454	4	99.1	454	3	99.3	454	4	99.1	454	4	99.1
CDN-ME-11	325	0	100	325	0	100	325	0	100	325	1	99.7
CDN-ME-16	131	0	100	131	0	100	131	0	100	131	0	100
CDN-ME-19	218	0	100	218	0	100	218	0	100	218	1	99.5
CDN-ME-1206	187	0	100	187	0	100	187	0	100	187	0	100
CDN-ME-1302	63	0	100	63	0	100	63	0	100	63	0	100
CDN-ME-1306	1	0	100	1	0	100	1	0	100	1	0	100
CDN-SE-1	174	0	100	174	0	100	174	0	100	174	0	100
CDN-SE-2	189	0	100	189	0	100	189	0	100	189	0	100
PB111	6	0	100	6	1	83.3	6	0	100	-	-	-
PB114	47	0	100	47	0	100	47	1	97.9	-	-	-
PLA-03	384	0	100	384	2	99.5	384	1	99.7	384	0	100
PLB-01	191	0	100	191	0	100	191	0	100	191	1	98.5
PLM-02	482	0	100	482	0	100	482	1	99.8	482	1	99.8
<b>Total</b>	<b>8093</b>	<b>11</b>	<b>99.9</b>	<b>7745</b>	<b>19</b>	<b>99.8</b>	<b>8093</b>	<b>26</b>	<b>99.7</b>	<b>8040</b>	<b>29</b>	<b>99.6</b>

\*Fail being a reported value  $\geq \pm 3$  standard deviations from SRM best value

Submitted certified standards indicate the Bateas laboratory has acceptable levels of accuracy for silver, lead, zinc, and gold with all elements reporting greater than 99 percent pass rates. The assay results for most standards demonstrate little or no bias.

#### ALS Chemex Laboratory

Drill core (exploration and infill) is sent to ALS Chemex for assaying. As described above, silver, zinc, and lead are assayed by inductively coupled plasma atomic emission spectroscopy (ICP-AES), unless the grade is greater than 100 g/t for silver, or 1 percent for lead or zinc, in which case the sample is re-assayed by aqua regia digestion with an ICP-AES or atomic absorption finish up to a maximum of 1,500 g/t silver, 30 percent lead, or 60 percent zinc. If the silver grade was found to be greater than 1,500 g/t it was re-assayed by fire assay using a gravimetric finish. If the lead or zinc grades were found to be higher than their upper limits they were re-assayed by titration. A total of 1,560



standards have been submitted by Miner Bateas with drill core as of June 30, 2015 to the ALS Chemex facilities representing a submission rate of 1 in 19 samples.

The results for blind SRM's inserted by Minera Bateas to the ALS Chemex laboratory are displayed in Table 11.3.

**Table 11.3 Results for SRM's submitted to the ALS Chemex laboratory**

Standard	Silver			Lead			Zinc			Gold		
	No. inserted	No. fails*	Pass rate (%)	No. inserted	No. fails*	Pass rate (%)	No. inserted	No. fails*	Pass rate (%)	No. inserted	No. fails*	Pass rate (%)
AGA-03	110	1	99.1	110	4	96.4	110	3	97.3	108	18	83.3
AGB-01	123	13	89.4	123	14	88.6	123	2	98.4	123	2	98.4
AGM-02	173	5	97.1	173	8	95.4	173	2	98.8	173	3	98.3
CDN-FCM-2	39	12	69.2	39	2	94.9	39	2	94.9	39	0	100
CDN-FCM-3	9	0	100	9	0	100	9	0	100	9	0	100
CDN-FCM-6	114	1	99.1	114	6	94.7	114	2	98.3	114	4	96.5
CDN-HC-2	2	0	100	2	0	100	2	0	100	2	0	100
CDN-HLHC	9	0	100	9	7	22.2	9	1	88.9	9	0	100
CDN-HLHZ	38	0	100	38	5	86.8	38	5	86.8	38	0	100
CDN-HLLC	33	14	57.6	33	1	97.0	33	3	90.91	33	1	97.0
CDN-HZ-2	13	3	76.9	13	0	100	13	0	100	13	3	76.9
CDN-HZ-3	36	0	100	36	5	86.1	36	2	94.4	36	8	77.8
CDN-ME-2	84	0	100	-	-	-	84	2	97.6	84	2	97.6
CDN-ME-3	10	0	100	10	0	100	10	0	100	10	0	100
CDN-ME-4	21	0	100	21	0	100	21	3	85.7	21	0	100
CDN-ME-5	183	0	100	183	0	100	183	31	83.1	183	30	83.6
CDN-ME-6	13	0	100	13	0	100	13	0	100	13	0	100
CDN-ME-7	54	1	98.2	54	1	98.2	54	9	83.3	54	2	96.3
CDN-ME-8	63	2	96.8	63	1	98.4	63	5	92.1	63	2	96.8
CDN-ME-11	114	3	97.4	114	1	99.1	114	17	85.1	114	2	98.3
CDN-ME-12	33	0	100	33	0	100	33	2	93.9	33	0	100
CDN-ME-15	19	8	57.9	19	12	36.8	19	5	73.7	19	0	100
CDN-ME-16	6	0	100	6	0	100	6	0	100	6	0	100
CDN-ME-17	78	2	97.4	78	1	98.7	78	3	96.2	78	2	97.4
CDN-ME-19	4	0	100	4	0	100	4	0	100	4	0	100
CDN-ME-1302	1	0	100	1	0	100	1	0	100	1	0	100
CDN-SE-1	24	0	100	24	0	100	24		100	24	0	100
CDN-SE-2	32	0	100	32	0	100	32	2	93.8	32	0	100
PLA-03	56	0	100	56	0	100	56	6	89.3	56	1	98.2
PLB-01	16	0	100	16	0	100	16	1	93.8	16	1	93.8
PLM-02	50	5	90.0	50	4	92.0	50	2	96.0	50	3	94.0
<b>Total</b>	<b>1560</b>	<b>70</b>	<b>95.5</b>	<b>1476</b>	<b>72</b>	<b>95.1</b>	<b>1560</b>	<b>110</b>	<b>93.0</b>	<b>1558</b>	<b>84</b>	<b>94.6</b>
*Fail being a reported value $>\pm 3$ standard deviations from SRM best value												

Results for SRM's submitted to the ALS Chemex laboratory indicate a reasonable level of accuracy is maintained by the laboratory for the four elements of interest with all reporting a pass rate of greater than 93 percent.

#### 11.4.2 Blanks

Field blank samples are composed of material that is known to contain grades that are less than the detection limit of the analytical method in use (or in the case of Pb and Zn are known to be very low) and are inserted by the geologist in the field. Blank sample analysis is a method of determining sample switching and cross-contamination of

samples during the sample preparation or analysis processes. Minera Bateas uses coarse quartz sourced from outside the area and provided by an external supplier as their blank sample material. The blank is tested to ensure the material does not contain elevated values for the elements of interest.

#### **Bateas Laboratory**

The analysis focuses on the submission of 7,045 blanks with channel samples as of June 30, 2015 representing a submission rate of 1 in 26 samples. The results of the analysis for each element are displayed in Table 11.4.

**Table 11.4 Results for blanks submitted to the Bateas laboratory**

Silver			Lead			Zinc			Gold		
No. inserted	No. fails*	Pass rate (%)	No. inserted	No. fails*	Pass rate (%)	No. inserted	No. fails*	Pass rate (%)	No. inserted	No. fails*	Pass rate (%)
7,045	0	100	7,045	0	100	7,045	2	99.9	7,045	9	99.9

The results of the blanks submitted indicate that cross contamination and mislabeling are not material issues at the Bateas laboratory.

#### **ALS Chemex Laboratory**

A total of 1,521 blanks were submitted with drill core as of June 30, 2015 to the ALS Chemex facilities representing a submission rate of 1 in 19 samples.

The results for blind blanks inserted by Minera Bateas to the ALS Chemex laboratory are displayed in Table 11.5.

**Table 11.5 Results for blanks submitted to the ALS Chemex laboratory**

Silver			Lead			Zinc			Gold		
No. inserted	No. fails*	Pass rate (%)	No. inserted	No. fails*	Pass rate (%)	No. inserted	No. fails*	Pass rate (%)	No. inserted	No. fails*	Pass rate (%)
1,521	10	99.3	1,521	20	98.7	1,521	37	97.6	1,521	3	99.8

The results of blanks used to monitor the ALS Chemex preparation and analytical facilities are regarded as acceptable and indicate that contamination and sample switching is not a significant issue at the laboratory.

#### **11.4.3 Duplicates**

The precision of sampling and analytical results can be measured by re-analyzing the same sample using the same methodology. The variance between the measured results is a measure of their precision. Precision is affected by mineralogical factors such as grain size and distribution and inconsistencies in the sample preparation and analysis processes. There are a number of different duplicate sample types which can be used to determine the precision for the entire sampling process. The terminologies for the duplicates employed by Fortuna at its operations are detailed Table 11.6.

**Table 11.6 Terminology employed by Fortuna for duplicates**

Duplicate Type	Description
Field	Sample generated by another sampling operation at the same collection point. Includes a second channel sample taken parallel to the first or the second half of drill core sample and submitted in the same or separate batch to the same (primary) laboratory.
Preparation	Second sample obtained from splitting the coarse crushed rock during sample preparation and submitted in the same batch by the laboratory.
Laboratory	Second sample obtained from splitting the pulverized material during sample preparation and submitted in the same batch by the laboratory.
Reject assay	Second sample obtained from splitting the coarse crushed rock during sample preparation and submitted blind to the same or different laboratory that assayed the original sample.
Duplicate assay	Second sample obtained from splitting the pulverized material during sample preparation and submitted blind at a later date to the same laboratory that assayed the original pulp.
Check assay	Second sample obtained from the pulverized material during sample preparation and sent to an umpire laboratory for analysis.

Numerous plots and graphs are used on a monthly basis to monitor precision and bias levels. A brief description of the plots employed in the analysis of duplicate data, is described below:

- Absolute relative difference (ARD) statistics: relative difference of the paired values divided by their average.
- Scatter plot: assesses the degree of scatter of the duplicate result plotted against the original value, which allows for bias characterization and regression calculations.
- Precision plot: half absolute difference (HAD) of the sample pairs against their mean. The reference lines indicate different levels of precision.
- Ranked half absolute relative difference (HARD) of samples plotted against their rank percent value.

Duplicate results are reviewed monthly by Fortuna as part of an extensive quality assurance program and are regarded as demonstrating acceptable levels of precision.

#### **Bateas Laboratory**

Minera Bateas inserts field, preparation, and laboratory duplicates as part of a comprehensive QAQC program. Reject assays and check assays are sent to the certified laboratory of ALS Chemex to provide an external monitor to the precision of the Bateas laboratory. Standards and blanks are also submitted with the reject and check assays to monitor the accuracy of the ALS results. Field duplicates are submitted at a rate of 1 in 35, preparation and reject assays at a rate of 1 in 18, laboratory duplicates at a rate of 1 in 9, and duplicate assays at a rate of 1 in 24.

Results relating to the absolute relative difference for the various types of duplicates submitted to the Bateas laboratory up to June 30, 2015 are displayed in Table 11.7.



**Table 11.7 Duplicate results for Bateas laboratory**

Type of Duplicate	Metal	Assay Technique	No. of duplicates analyzed <sup>#</sup>	Percent of samples meeting ARD* acceptance criteria
<b>Field Duplicate<sup>1</sup></b>	<b>Ag</b>	AA	3,849	84
		FA-GRAV	190	91
	<b>Pb</b>	AA	3,465	83
		VOL	208	93
	<b>Zn</b>	AA	3,579	86
		VOL	313	98
	<b>Au</b>	FA-AA	2,894	81
		FA-GRAV	58	62
<b>Preparation duplicate<sup>2</sup></b>	<b>Ag</b>	AA	3,287	100
		FA-GRAV	254	100
	<b>Pb</b>	AA	3,447	100
		VOL	77	100
	<b>Zn</b>	AA	3,597	100
		VOL	150	100
	<b>Au</b>	FA-AA	2,718	99
		FA-GRAV	37	100
<b>Laboratory Duplicate<sup>3</sup></b>	<b>Ag</b>	AA	6,098	100
		FA-GRAV	360	100
	<b>Pb</b>	AA	5,886	100
		VOL	100	98
	<b>Zn</b>	AA	6,402	98
		VOL	147	100
	<b>Au</b>	FA-AA	1,601	89
		FA-GRAV	21	86
<b>Reject assays<sup>4</sup></b>	<b>Ag</b>	AA	2,268	98
		FA-GRAV	141	98
	<b>Pb</b>	AA	2,086	98
		VOL	58	100
	<b>Zn</b>	AA	2,140	100
		VOL	107	99
	<b>Au</b>	FA-AA	1,661	90
		FA-GRAV	17	94
<b>Duplicate assays (pulps)<sup>5</sup></b>	<b>Ag</b>	AA	1,288	95
		FA-GRAV	133	98
	<b>Pb</b>	AA	1,203	96
		VOL	26	96
	<b>Zn</b>	AA	1,352	96
		VOL	45	94
	<b>Au</b>	FA-AA	974	59
		FA-GRAV	18	56

\*ARD = Absolute Relative Difference

<sup>#</sup> Values that are less than x10 the lower detection limit for both laboratories have been excluded from the statistics.

1. Acceptable ARD value for field duplicates is >90% of the population being less than 0.3.
2. Acceptable ARD value for preparation duplicates is >90% of the population being less than 0.2.
3. Acceptable ARD value for laboratory duplicates is >90% of the population being less than 0.1.
4. Acceptable ARD value for reject assays is >90% of the population being less than 0.2.
5. Acceptable ARD value for "duplicate assay" pulps is >90% of the population being less than 0.1.

In general precision levels are reasonable with the majority of ARD values being greater than 90 percent. Field duplicate results are generally slightly lower than the accepted 90 percent threshold level but have improved over time through; closer supervision of the

sampling process; increasing the sampling mass; and estimation of the fundamental sampling error. With the implementation of these measures the ARD values of field duplicates have generally been greater than 90 percent over the last few years.

It should also be noted that precision levels for gold assays are lower than for the other elements, particularly for the duplicate assays. This is because gold concentrations are much lower and variability is higher. Gold is not an economic driver in the operation and therefore the cost associated with increasing sample mass to ensure higher precision levels is not justified.

Duplicates sent to the umpire laboratory showed reasonable levels of precision between the two laboratories. Quality control samples included with the duplicates sent to the umpire laboratory showed acceptable levels of accuracy and no issues with sample switching or contamination.

### ALS Chemex Laboratory

Prior to 2013 Minera Bateas relied only on the insertion of preparation and laboratory duplicates by ALS Chemex to monitor precision levels of drill core samples submitted to the ALS facilities. The QAQC policy was revised in late 2012 and Brownfields exploration have since submitted the full array of blind duplicates with drill core since January 2013. Results relating to the absolute relative difference (ARD) for the duplicates submitted to the ALS Chemex laboratory are detailed in Table 11.8.

**Table 11.8 Duplicate results for ALS Chemex laboratory**

Type of Duplicate	Metal	Assay Technique	No. of duplicates analyzed <sup>#</sup>	Percent of samples meeting ARD* acceptance criteria
Field Duplicate <sup>1</sup>	Ag	ICP-AES	226	69
		AA	43	86
	Pb	ICP-AES	253	69
		AA	21	81
	Zn	ICP-AES	243	77
		AA	40	85
	Au	FA-AA	180	79
		FA-GRAV	1	100
Preparation dulpicate <sup>2</sup>	Ag	ICP-AES	367	93
		AA	51	92
		FA-GRAV	2	100
	Pb	ICP-AES	415	95
		AA	41	93
	Zn	ICP-AES	461	96
		AA	61	98
	Au	FA-AA	212	91
FA-GRAV		1	100	
Laboratory Duplicate <sup>3</sup>	Ag	ICP-AES	1,171	91
		AA	726	99
		FA-GRAV	23	100
	Pb	ICP-AES	1,359	94
		AA	652	99
	Zn	ICP-AES	1,522	95
		AA	811	100
	Au	FA-AA	616	85
FA-GRAV		14	86	



Type of Duplicate	Metal	Assay Technique	No. of duplicates analyzed <sup>#</sup>	Percent of samples meeting ARD* acceptance criteria
Reject assays <sup>4</sup>	Ag	ICP-AES	249	93
		AA	88	97
	Pb	ICP-AES	271	96
		AA	54	99
		VOL	4	100
	Zn	ICP-AES	275	97
		AA	68	100
		VOL	2	100
	Au	FA-AA	293	93
		FA-GRAV	2	100
Duplicate assays (pulps) <sup>5</sup>	Ag	ICP-AES	217	81
		AA	77	100
	Pb	ICP-AES	241	82
		AA	52	98
		VOL	4	100
	Zn	ICP-AES	236	91
		AA	69	100
		VOL	2	100
	Au	FA-AA	258	78
		FA-GRAV	2	100
*ARD = Absolute Relative Difference				
<sup>#</sup> Values that are less than x10 the lower detection limit for both laboratories have been excluded from the statistics.				
1. Acceptable ARD value for field duplicates is >90% of the population being less than 0.3.				
2. Acceptable ARD value for preparation duplicates is >90% of the population being less than 0.2.				
3. Acceptable ARD value for laboratory duplicates is >90% of the population being less than 0.1.				
4. Acceptable ARD value for reject assays is >90% of the population being less than 0.2.				
5. Acceptable ARD value for “duplicate assay” pulps is >90% of the population being less than 0.1.				

Results for duplicates submitted with drill core to the ALS Chemex laboratory show acceptable levels of precision are maintained at the laboratory, with the exception of the field duplicates, which are slightly below the acceptance levels and tend to be related to the insertion of low grade or low mass samples.

#### 11.4.4 Quality control measures employed by Compania Minera Arcata

It is understood from the technical reports submitted by CAM (CAM, 2005, CAM, 2006 and CAM, 2009) that CMA employed a comprehensive QAQC program that was reviewed and validated by the authors of these reports. Fortuna has not been able to review this information but believes the findings of these independent reports are reliable.

The estimation of Animas, Animas NE, Bateas, Bateas Techo, Silvia, Soledad, Santa Catalina, Patricia, and Pilar do not rely on any CMA information. Estimates of La Plata, Cimoide La Plata, Paralela, San Carlos, San Cristóbal, and San Pedro use drill hole and channel samples obtained by both CMA and Minera Bateas. Minera Bateas has had limited access to the underground workings from where these samples were obtained to establish the reliability of the original results. Initial channel sample assays obtained by Minera Bateas from the San Cristobal vein tend to be lower than from CMA drill hole and channel samples. However, the area investigated is not extensive enough to draw meaningful conclusions at this time.

#### 11.4.5 Conclusions regarding quality control results

Analysis of standards and blanks submitted to both the Bateas laboratory and the independent ALS Chemex facilities indicate acceptable levels of accuracy for silver, lead, zinc, and gold grades. The results of the blanks submitted indicate that contamination or mislabeling of samples is not a material issue at either of the laboratories. Precision levels are good for the Bateas laboratory with the exception of gold which is slightly below the acceptance criteria. However, gold is not an economic driver in the operation and therefore the cost associated with increasing sample mass to ensure high precision levels is not justified. Precision levels are also acceptable for the ALS Chemex laboratory.

The high levels of accuracy, precision and lack of contamination indicate that grades reported from the Bateas and ALS Chemex laboratories are suitable for Mineral Resource estimation.

Fortuna was unable to verify the accuracy and precision of the CMA channel data with any certainty due to insufficient data. Assay results obtained by Minera Bateas in a limited portion of the San Cristóbal vein tend to be lower than those reported by CMA and this has been taken into account during resource classification.

### 11.5 Opinion on adequacy of sample preparation, security, and analytical procedures

It is the opinion of Mr. Eric Chapman (P. Geo.), a Qualified Person as defined by NI 43-101, that the sample preparation, security, and analytical procedures have been conducted in accordance with acceptable industry standards and that assay results generated following these procedures are suitable for use in Mineral Resource and Mineral Reserve estimation.



## 12 Data Verification

Minera Bateas mine site staff adhere to a stringent set of procedures for data storage and validation, performing verification of its data on a monthly basis. The operation employs a Database Administrator who is responsible for oversight of data entry, verification and database maintenance.

Data used for Mineral Resource estimation are stored in three databases. Minera Bateas information is stored in two of these databases, one storing data relating to the mine (including channel samples) and the other for storing drilling results. Both databases are in a SQL Server format. A separate Microsoft Access database is used for the storage of recovered CMA information.

Data relating to drill hole and channel samples taken by CMA were collated in 2008 and 2009 through a careful data recovery process from historical documents and assay certificates. The databases are fully validated annually by Fortuna as part of the Mineral Resource estimation process. The database storing CMA information was not validated in 2015 based on the fact that no new information has been acquired since the previous validation in 2010.

A preliminary validation of the databases was performed by the Minera Bateas geology department in June 2015. The onsite databases have a series of automated import, export, and validation tools to minimize potential errors.

Both databases were then reviewed and validated by Mr. Eric Chapman (P. Geo). The data verification procedure involved the following:

- Inspection of selected drill core to assess the nature of the mineralization and to confirm geological descriptions
- Inspection of geology and mineralization in underground workings of the Animas and Bateas veins
- Verification that collar coordinates coincide with underground workings or the topographic surface
- Verification that downhole survey bearing and inclination values display consistency
- Evaluation of minimum and maximum grade values
- Investigation of minimum and maximum sample lengths
- Randomly selecting assay data from the databases and comparing the stored grades to the original assay certificates
- Assessing for inconsistencies in spelling or coding (typographic and case sensitivity errors)
- Ensuring full data entry and that a specific data type (collar, survey, lithology, and assay) is not missing
- Assessing for sample gaps or overlaps

A small number of inconsistencies were noted generally relating to coding (i.e. geological codes entered in both upper and lower case) and were subsequently corrected.



After correcting all inconsistencies, the databases were accepted as validated on June 30, 2015. A copy of the databases was stored in a designated folder on the server and no further data inputs were accepted after the data cut-off date.

Based on the data verification detailed above, Fortuna's Corporate Head of Technical Services Mr. Eric Chapman, P. Geo., considers the Minera Bateas and CMA data to be suitable for the estimation of classified Mineral Resources and Mineral Reserves.

## 13 Mineral Processing and Metallurgical Testing

The Caylloma concentrator plant was purchased from CMA as part of the overall purchase of the Caylloma Property. Major modifications have been made to the plant following the purchase of the property by Fortuna.

Numerous metallurgical tests and studies have been conducted in the concentrator plant since Minera Bateas took over in order to optimize mineral processing.

Metallurgical recoveries for 2015 were 83.03 %, 93.98 %, and 90.79 % for Silver, Lead and Zinc respectively, an important improvement compared to those achieved in 2012 (77.33 %, 88.12 %, and 85.77 %, respectively). Minera Bateas continues to work on optimizing the mineral processing operation focusing on metallurgical recoveries and processing capacity. The studies or tests developed to achieve these goals include:

1. Plant test work for oxides

Until 2012 ore identified as containing high PbOx and ZnOx content was classified as oxides not amenable for flotation processing.

Different plant and laboratory tests were carried out during 2012. The maximum metallurgical recoveries achieved during the plant test work were 63.98 % for silver, 46.45 % for lead and 32.35 % for zinc.

More laboratory and plant tests were scheduled for 2013 including the metallurgical testing of the different levels of the Animas vein. The main conclusion was that ZnOx contents greater than 0.20 % within the ore were related to the lower metallurgical recoveries. In order to include this type of ore without affecting the metallurgical recoveries blending has to be performed to limit the high ZnOx ore content.

2. Mineralogical balancing of products for the lead circuit

In June 2012, Minera Bateas requested Blue Coast Metallurgy (BCM) to conduct a mineralogical study of concentrate and tailings products from the lead circuit. The study aimed to characterize the lead and silver mineral species in both products and identify the form(s) in which the lead and silver are recovered and lost in terms of size and liberation.

Based on the studies and testing developed between 2013 and 2015 for the different stages of the process some changes or adjustments have been implemented in the processing plant aimed at improving the metallurgical performance including:

- Adjustments to the grinding medium and size selection were made in order to achieve 60 percent passing 75 microns as the final grinding product
- The Z-11 and Z-6 collectors in the lead flotation circuit, which were previously added as a mixed solution, are now added independently ensuring a superior effect and avoiding alteration in their properties
- The Sodium Cyanide consumption, which is used as a Fe and Zn depressor in the Ag-Pb flotation circuit, is reduced from 20 to 10 g/t aiming to promote the Ag and Au flotation

- The Denver mill critical speed was increased from 69 percent to 76 percent increasing the reduction ratio, resulting in an increase in the treatment capacity of 10 tpd
- The Magensa (6 foot by 6 foot) mill steel shell liners were changed to rubber increasing the reduction ratio from 1.20 to 1.60
- Automatic pH control was installed to stabilize the process, particularly in the Zn circuit, reducing lime consumption by 200 g/t

### 3. Processing plant optimization

Aiming to reduce the recirculating load within the grinding circuit by improving the size selection, pilot tests to replace cyclones with high frequency vibrating wet screens were run by the Derrick Plant in Buffalo, New York in November 2014.

Results indicated a circulating load reduction from 250 to 170 percent thanks to a more efficient size classification thereby allowing improved grinding, and ultimately, an increase in the plant processing capacity.

To achieve that goal and based on laboratory testing, the flotation time was increased from 14 to 38 minutes by increasing the Ag-Pb flotation circuit capacity.

In March 2015, the Processing Plant Optimization Project (POP) was initiated. The optimization project was aimed at increasing the processing capacity from 1,300 to a potential maximum of 1,500 tpd by improvements in the grinding and flotation circuits. The total investment in the project was US\$ 4.6 Million with project completion in March 2016.

## 14 Mineral Resource Estimates

### 14.1 Introduction

The following sections describe in detail the Mineral Resource estimation methodology of the veins warranting updating. These include the Animas, Animas NE, Bateas, Bateas Techo, Bateas Piso, La Plata, Cimoide La Plata, Soledad, and Nancy veins. The chapter also describes the first time estimation of the newly drilled Ramal Piso Carolina and Don Luis II veins. Veins that were previously estimated using a 2D methodology were updated using 3D block model estimation methods and included the Paralela, Ramal Paralela, San Carlos, and San Pedro veins.

If no new information for a vein was obtained since the previous Technical Report (Chapman & Kelly, 2013) the previous result was retained, albeit with the application of new metal prices and cut-off grades. Veins that did not require updating included Silvia, Santa Catalina, Patricia, Pilar, and San Cristobal. A summary of the estimation methodology used to estimate these veins has been included for completeness.

### 14.2 Disclosure

Mineral Resources were prepared by Minera Bateas, under the technical supervision of Eric Chapman, P.Geo. Mr. Chapman is a Qualified Person as defined in National Instrument 43-101 and an employee of Fortuna.

Mineral Resources are estimated as of June 30, 2015 and reported as of December 31, 2015, taking into account extraction related depletion between July and year end.

Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

#### 14.2.1 Known issues that materially affect Mineral Resources

Fortuna does not know of any issues that materially affect the Mineral Resource estimates. These conclusions are based on the following:

##### Environmental

Minera Bateas is in compliance with Environmental Regulations and Standards set in Peruvian Law and has complied with all laws, regulations, norms and standards at every stage of operation of the mine.

##### Permitting

Minera Bateas has represented that permits are in good standing.

##### Legal

Minera Bateas has represented that there are no outstanding legal issues; no legal action, and injunctions are pending against the Project.

##### Title

Minera Bateas has represented that the mineral and surface rights have secure title.

##### Taxation

No known issues.

### Socio-economic

Minera Bateas has represented that the Project has strong local community support.

### Marketing

No known issues.

### Political

Minera Bateas believes that the current government is supportive of the Project.

### Other relevant issues

No known issues.

### Mining

Minera Bateas has been successfully operating a mining facility at Caylloma since 2006, which has included extraction from the Animas, Animas NE, Bateas, Soledad, Silvia, Santa Catalina veins. Underground mining has also been successfully performed (prior to the collapse in silver metal prices in the late 1990's and early 2000's) by Compania Minera Arcata including extraction of mineralized material from the San Cristóbal, Bateas, Santa Catalina, San Pedro, Paralela, and San Carlos veins.

### Metallurgical

Minera Bateas presently successfully treats ore extracted from the Caylloma Mine in the onsite processing plant to produce lead and zinc concentrates with gold and silver credits (Section 13).

### Infrastructure

No known issues.

## 14.3 Assumptions, methods and parameters

The 2015 Mineral Resource estimates for new veins and those requiring updating (Animas/Animas NE, Bateas/Bateas Techo/Bateas Piso, La Plata/Cimoide La Plata, Soledad, Ramal Piso Carolina, Don Luis II and Nancy veins) were prepared in the following way:

- Data validation as performed by Fortuna
- Data preparation including importation to various software packages
- Geological interpretation and modeling of mineralization domains
- Coding of drill hole and channel data within mineralized domains
- Sample length compositing of both drill holes and channel samples
- Analysis of extreme data values and application of top cuts
- Exploratory data analysis of the key constituents – Ag, Au, Pb, Zn, and density
- Analysis of boundary conditions
- Variogram analysis and modeling
- Derivation of kriging plan
- Kriging neighborhood analysis and creation of block models

- Grade interpolation of Ag, Au, Pb, Zn, and sample length, assignment of density values
- Validation of grade estimates against input sample data
- Classification of estimates with respect to CIM guidelines
- Assignment of a net smelter return (NSR) based on long term metal prices, metallurgical recoveries, smelting costs, commercial contracts, and average concentrate grades
- Mineral Resource tabulation and reporting

If no new information for a vein was available since the previous Mineral Resource estimation the grade values were not re-estimated. However, the methodology and results were reviewed and updated metal prices and costs were applied to provide a current NSR value, and the resource classification was reassessed. This was the case for the Silvia, Santa Catalina, Patricia, Pilar, and San Cristobal veins.

## 14.4 Supplied data, data transformations and data validation

Minera Bateas information used in the 2015 estimation is sourced from two databases, one stores data relating to the mine (including channel samples) and the other for storage of drilling results. Both databases are in SQL Server format. A separate Microsoft Access database is used for the storage of recovered Compania Minera Arcata (CMA) historic information.

The two databases storing the Minera Bateas channel and drill hole data have been used for the estimation of the Animas, Animas NE, Bateas/Bateas Techo/Bateas Piso, La Plata/Cimoide La Plata, Soledad, Nancy, Ramal Piso Carolina, and Don Luis II, Paralela, Ramal Paralela, San Carlos, and San Pedro veins. Veins that are reported but were not updated in the 2015 Mineral Resource estimate (Silvia, Santa Catalina, Patricia, Pilar, and San Cristobal) also have their drill hole and channel data stored in these databases.

The database storing the historical CMA data has also been used for estimating the La Plata, Silvia, Santa Catalina, Patricia, and Pilar vein. Additionally, veins that are reported but were not updated in the 2015 Mineral Resource estimate (San Cristobal) use CMA drill hole and channel data stored in their own databases.

Minera Bateas supplied all available data as of June 30, 2015.

### 14.4.1 Data transformations

Historical assays recorded by CMA were in troy ounces per tonne and these were transformed to grams per tonne by Minera Bateas before being used in the estimation process. The transformation was made by multiplying the troy ounces by 31.1035 to calculate the equivalent grams. No other data transformations were required.

### 14.4.2 Software

Mineral Resource estimates have relied on several software packages for undertaking modeling, statistical, geostatistical and grade interpolation activities. Wireframe modeling of the mineralized envelopes was performed in Leapfrog version 2.6. Data preparation, block modeling and grade interpolations were performed in Datamine Studio version 3.24.25. Statistical and variographic analysis was performed in Supervisor version 8.





### 14.4.3 Data preparation

Collar, survey, lithology, and assay data exported from the drill hole database, mine (channels) database, and CMA database provided by Minera Bateas were imported into Datamine and used to build 3D representations of the drill holes and channels. Drill holes or intervals that contained known missing information were removed from the analysis. Assay values at or below the detection limit were corrected to half the detection limit. The number of surface drill holes, underground drill holes and channels used in the geologic interpretation process during the Caylloma 2015 Mineral Resource estimate is shown in Table 14.1.

**Table 14.1 Drill holes and channels used in the 2015 Mineral Resource estimate**

Vein	Surface Drill holes		Underground Drill holes		Channels	
	Number	Meters	Number	Meters	Number	Meters
Animas	76	20,341	169	12,174	28,016	70,875
Animas NE	69	14,053			13,133	36,335
Bateas	73	16,452	151	13,506	16,167	14,797
Bateas Techo					289	254
Silvia			28	2,644	1,176	1,872
Soledad	7	924	30	2,986	6,802	6,673
Santa Catalina	3	551	11	1,500	1,740	3,580
Patricia			19	1,665	38	32
Pilar			2	144	63	105
La Plata**	32	6,987	23	2,267	373	292
Cimoide La Plata**					311	377
San Cristóbal*	6	2,279	26	2,824	5,201	10,030
Paralela					623	936
San Carlos*	2	496	10	481	295	145
San Pedro*	6	2,456	8	1,253	2,006	2,646
Nancy	29	6,754	2	768		
Carolina & Ramal Piso Carolina	72	17,577				
Don Luis II	45	12,937				
<b>Total</b>	<b>420</b>	<b>101,806</b>	<b>479</b>	<b>42,211</b>	<b>76,233</b>	<b>148,949</b>
Notes: Some drill holes intersect multiple veins. Number and meters were attributed to the primary target vein * Includes CMA channel samples. # Drill holes intersect both La Plata and Cimoide La Plata veins. Totals may not add due to rounding						

### 14.4.4 Data validation

An extensive data validation process was conducted by Minera Bateas and the Technical Services of Fortuna prior to Mineral Resource estimation with a more detailed description of this process provided in Section 12.

Validation checks were also performed upon importation into Datamine mining software and included searches for overlaps or gaps in sample and geology intervals, inconsistent drill hole identifiers, and missing data. No significant discrepancies were identified.

## 14.5 Geological interpretation and domaining

Caylloma is a low sulfidation epithermal style deposit, primarily consisting of sulfosalts and silver sulfides and base metal sulfides. Mineralization is associated with distinct veins characterized by Ag sulfosalts and base metal sulfides in a banded gangue of quartz, rhodonite and calcite. Host rocks adjacent to the veins are characterized by local illite, and widespread propylitic alteration.

Major vein systems recognized at the Caylloma Property, have a general northeast to southwest strike orientation and dipping predominantly to the southeast. Wall rocks are andesitic lavas, pyroclastics and volcanoclastics of the Tacaza volcanic group.

There are two different types of mineralization at Caylloma; the first is comprised of silver-rich veins with low concentrations of base metals. The second type of vein is polymetallic in nature with elevated silver, lead, zinc, copper, and gold grades.

### Silver veins

- Bateas, Bateas Piso, Bateas Techo, La Plata, Cimoide La Plata, San Cristóbal, San Pedro, San Carlos, Paralela, Ramal Piso Carolina, and Don Luis II veins

### Polymetallic veins

- Animas, Animas NE, Santa Catalina, Soledad, Silvia, Pilar, Patricia, and Nancy veins

Mineralized envelopes were constructed by the Minera Bateas geological department based on the interpretation of the deposit geology and refined using the drill hole, channel and underground mapping information. The mineralized wireframes were modeled in Leapfrog based on channel and drill hole intersections that have an average combined (Ag, Au, Pb, and Zn) NSR value greater than US\$50 (regarded as being potentially economically extractable). Prices used for determining the metal value were based on long term metal prices as summarized in Table 14.2.

**Table 14.2 Metal prices used to define mineralized envelopes**

Metal	Price
Ag	19 US\$/oz
Au	1,140 US\$/oz
Pb	2,150 US\$/t
Zn	2,300 US\$/t

## 14.6 Exploratory data analysis

### 14.6.1 Compositing of assay intervals

Compositing of sample lengths was undertaken so that the samples used in statistical analyses and estimations have similar support (i.e., length). Minera Bateas sample drill holes and channels at varying interval lengths depending on the length of intersected geological features and the true thickness of the vein structure. Sample lengths were examined for each vein and composited according to the most frequently sampled length interval (Table 14.3). The composited and raw sample data were compared to ensure no sample length loss or metal loss had occurred.

The Datamine COMPDH downhole compositing process was used to composite the samples within the estimation domains (i.e. composites do not cross over the mineralized domain boundaries). The COMPDH parameter MODE was set to a value of one to allow adjusting of the composite length while keeping it as close as possible to the composite interval; this is done to minimize sample loss.

**Table 14.3 Composite length by vein**

<b>Vein</b>	<b>Composite length (m)</b>
<b>Animas</b>	2.5
<b>Animas NE</b>	2.5
<b>Bateas (incl. Techo &amp; Piso)</b>	1
<b>Silvia</b>	1.5
<b>Soledad</b>	1
<b>Santa Catalina</b>	2
<b>Patricia</b>	1
<b>Pilar</b>	1
<b>La Plata</b>	1
<b>Cimoide La Plata</b>	1
<b>San Cristobal</b>	2
<b>Paralela</b>	1
<b>San Carlos</b>	1
<b>San Pedro</b>	1
<b>Nancy</b>	1
<b>Ramal Piso Carolina</b>	1
<b>Don Luis II</b>	1

Due to the variable thickness of the veins it was noted that composite lengths were still variable with a high proportion being less than the composite length. In previous estimates this composite length variation has been successfully dealt with by weighting the estimate by the composite length and therefore this methodology was employed in 2015 and further explained in Section 14.8.4.

#### 14.6.2 Statistical analysis of composites

Exploratory data analysis was performed on composites identified in each geological vein (Table 14.4). Splays have been identified separately and samples composited within these domains as detailed below. Statistical and graphical analysis (including histograms, probability plots, scatter plots) were investigated for each vein to assess if additional sub-domaining was required to achieve stationarity.

A high-grade domain was identified and separated in the La Plata and Bateas Piso veins. The La Plata high-grade domain is defined by the presence of 192 composite in a restricted region of the vein, averaging 3,085 g/t Ag and 4.01 g/t Au whereas the rest of the vein averages 308 g/t Ag and 1.30 g/t Au. The Bateas Piso high-grade domain is defined by the presence of 1,004 composites (mainly channels) in a restricted region of the vein, averaging 1,645 g/t Ag whereas the rest of the vein averages 39 g/t Ag. The high-grade regions were domained separately so as to prevent smearing of the higher grades into the lower grade domains.



**Table 14.4 Univariate statistics of undeclustered composites by vein**

Vein	Grade	Count	Minimum	Maximum	Mean	Variance	Std. Dev.
<b>Animas (Main)</b>	Ag (g/t)	28,924	0.1	15,351	<b>147</b>	127,417	357
	Au (g/t)	28,924	0.0005	168.36	<b>0.50</b>	7.36	2.71
	Pb (%)	28,924	0.0001	44.04	<b>1.83</b>	5.94	2.44
	Zn (%)	28,924	0.0001	31.13	<b>3.20</b>	10.51	3.24
<b>Animas (Splay)</b>	Ag (g/t)	202	2.0	153	<b>40</b>	781	28
	Au (g/t)	202	0.029	4.68	<b>0.19</b>	0.08	0.28
	Pb (%)	202	0.045	9.05	<b>2.06</b>	2.77	1.66
	Zn (%)	202	0.0916	12.32	<b>3.98</b>	5.44	2.33
<b>Animas NE (Main)</b>	Ag (g/t)	13,608	0.1	5,330	<b>111</b>	14,385	120
	Au (g/t)	13,608	0.0005	92.53	<b>0.30</b>	1.27	1.13
	Pb (%)	13,608	0.0001	49.73	<b>3.32</b>	15.47	3.93
	Zn (%)	13,608	0.0001	31.01	<b>4.25</b>	11.70	3.42
<b>Animas NE (Splay)</b>	Ag (g/t)	276	1.13	2,046	<b>163</b>	70,272	265
	Au (g/t)	276	0.06	17.95	<b>1.06</b>	3.61	1.90
	Pb (%)	276	0.05	9.95	<b>2.29</b>	3.55	1.88
	Zn (%)	276	0.109	8.21	<b>2.08</b>	1.73	1.31
<b>Bateas (Main)</b>	Ag (g/t)	15,289	0.1	31,294	<b>820</b>	2,337,292	1,529
	Au (g/t)	15,289	0.0005	117.32	<b>0.31</b>	6.54	2.56
	Pb (%)	15,289	0.0001	12.80	<b>0.56</b>	0.57	0.76
	Zn (%)	15,289	0.0001	23.92	<b>0.86</b>	1.28	1.13
<b>Bateas (Splay)</b>	Ag (g/t)	162	3.0	11,653	<b>1,132</b>	2,444,645	1,564
	Au (g/t)	162	0.007	28.82	<b>0.87</b>	9.83	3.14
	Pb (%)	162	0.005	3.20	<b>0.76</b>	0.46	0.68
	Zn (%)	162	0.01	4.75	<b>1.36</b>	1.35	1.16
<b>Bateas Piso (Low grade)</b>	Ag (g/t)	98	0.1	815	<b>39</b>	8,084	90
	Au (g/t)	98	0.0025	0.30	<b>0.06</b>	0.004	0.06
	Pb (%)	98	0.0001	2.42	<b>0.05</b>	0.06	0.25
	Zn (%)	98	0.0001	3.99	<b>0.09</b>	0.16	0.40
<b>Bateas Piso (High grade)</b>	Ag (g/t)	1,004	3	29,077	<b>1,645</b>	7,352,319	2,712
	Au (g/t)	1,004	0.01	49.50	<b>0.66</b>	6.12	2.47
	Pb (%)	1,004	0.0001	2.82	<b>0.33</b>	0.13	0.37
	Zn (%)	1,004	0.0001	5.54	<b>0.59</b>	0.43	0.65
<b>Bateas Techo</b>	Ag (g/t)	148	0.10	2,503	<b>171</b>	88,146	297
	Au (g/t)	148	0.003	59.50	<b>0.46</b>	14.99	3.87
	Pb (%)	148	0.0001	0.43	<b>0.04</b>	0.00	0.06
	Zn (%)	148	0.0001	1.27	<b>0.06</b>	0.02	0.14
<b>Silvia</b>	Ag (g/t)	1,303	0.50	2,784	<b>91</b>	16,305	128
	Au (g/t)	1,303	0.0025	94.15	<b>0.62</b>	12.85	3.58
	Pb (%)	1,303	0.0005	17.68	<b>1.73</b>	5.70	2.39
	Zn (%)	1,303	0.0005	23.92	<b>2.59</b>	6.79	2.61
<b>Soledad (Main)</b>	Ag (g/t)	6,604	1.00	52,224	<b>458</b>	1,984,597	1,409
	Au (g/t)	6,604	0.0008	170.99	<b>2.35</b>	39.36	6.27
	Pb (%)	6,604	0.0028	25.14	<b>1.36</b>	3.43	1.85
	Zn (%)	6,604	0.0094	15.94	<b>1.69</b>	2.35	1.53



Vein	Grade	Count	Minimum	Maximum	Mean	Variance	Std. Dev.
<b>Soledad (Splay)</b>	Ag (g/t)	298	3.00	1,820	<b>161</b>	30,485	175
	Au (g/t)	298	0.035	46.75	<b>3.94</b>	36.62	6.05
	Pb (%)	298	0.015	19.73	<b>2.63</b>	4.89	2.21
	Zn (%)	298	0.0198	17.97	<b>4.56</b>	10.08	3.17
<b>Santa Catalina</b>	Ag (g/t)	1,824	0.50	2,043	<b>135</b>	25,709	160
	Au (g/t)	1,824	0.0025	86.65	<b>1.20</b>	17.44	4.18
	Pb (%)	1,824	0.0005	29.65	<b>1.67</b>	4.06	2.02
	Zn (%)	1,824	0.0005	14.44	<b>2.42</b>	3.74	1.93
<b>Patricia</b>	Ag (g/t)	71	9.22	1,948	<b>207</b>	98,862	314
	Au (g/t)	71	0.0175	6.63	<b>0.69</b>	1.57	1.25
	Pb (%)	71	0.0103	6.42	<b>0.52</b>	1.08	1.04
	Zn (%)	71	0.02	8.05	<b>0.70</b>	1.61	1.27
<b>Pilar</b>	Ag (g/t)	50	0.50	897	<b>117</b>	26,621	163
	Au (g/t)	50	0.0025	44.10	<b>1.88</b>	37.57	6.13
	Pb (%)	50	0.0005	4.14	<b>0.53</b>	0.65	0.81
	Zn (%)	50	0.0005	7.19	<b>0.59</b>	1.22	1.10
<b>La Plata (Low grade)</b>	Ag (g/t)	107	0.1	6,109	<b>308</b>	586,110	766
	Au (g/t)	107	0.0025	53.80	<b>1.30</b>	33.86	5.82
<b>La Plata (High grade)</b>	Ag (g/t)	192	3.1	14,184	<b>3,085</b>	8,602,103	2,933
	Au (g/t)	192	0.0025	107.60	<b>4.01</b>	87.67	9.36
<b>Cimoide La Plata</b>	Ag (g/t)	378	4.0	22,144	<b>483</b>	2,369,246	1,539
	Au (g/t)	378	0.001	137.45	<b>2.42</b>	101.14	10.06
<b>San Cristóbal</b>	Ag (g/t)	5,116	0.5	17,471	<b>290</b>	501,220	708
	Au (g/t)	5,116	0.0025	99.86	<b>0.33</b>	7.09	2.66
<b>Paralela</b>	Ag (g/t)	910	0.7	15,676	<b>310</b>	518,869	720
	Au (g/t)	210	0.005	4.52	<b>0.68</b>	0.76	0.87
<b>San Carlos</b>	Ag (g/t)	294	15.55	3,060	<b>396</b>	327,777	572.52
	Au (g/t)	106	0.1	21.3	<b>0.70</b>	4.79	2.19
<b>San Pedro</b>	Ag (g/t)	2,385	3.11	18,000	<b>534</b>	1,304,900	1,142
	Au (g/t)	305	0.005	126	<b>3.89</b>	74.49	8.63
<b>Nancy</b>	Ag (g/t)	117	2	321	<b>92</b>	4,603	68
	Au (g/t)	117	0.015	157.50	<b>3.00</b>	293.71	17.14
	Pb (%)	117	0.07	21.10	<b>3.70</b>	15.54	3.94
	Zn (%)	117	0.056	18.54	<b>4.33</b>	21.67	4.65
<b>Ramal Piso Carolina</b>	Ag (g/t)	82	1.2	1,759	<b>127</b>	50,815	225.42
	Au (g/t)	82	0.0168	60.16	<b>5.16</b>	92.54	9.62
<b>Don Luis II (Main)</b>	Ag (g/t)	56	30.48	1,894	<b>372</b>	175,039	418.38
	Au (g/t)	56	0.015	110.17	<b>3.38</b>	219.94	14.83
<b>Don Luis II (Splay)</b>	Ag (g/t)	18	0.93	181	<b>81</b>	3,011	54.87
	Au (g/t)	18	0.0025	1.58	<b>0.24</b>	0.17	0.41

#### 14.6.3 Sub-domaining

Mineralization in the Animas and Animas NE veins has been explored closer to the surface than any of the other veins. Through the investigation of the mineralogy and grade characteristics a partially oxidized domain and a zinc oxide domain have been identified. Samples have been coded as oxide or sulfide for estimation purposes and

areas of high zinc oxide ( $> 0.2\%$  ZnOx) have been sub-domained in the block model as this material has to be blended to ensure metallurgical recoveries do not drop in the plant.

A number of the veins are comprised of a main component and a separate splay vein or a high and low grade region, as detailed in Table 14.4. The main and splay vein, or high and low grade area, have been domained and estimated separately to ensure grade stationarity and prevent smearing of grades between the domains.

Internal waste was also identified as being present in the Animas/Animas NE vein and to a lesser degree in the Bateas vein. These areas of internal waste were sub-domained and samples identified within coded as waste for estimation purposes.

#### 14.6.4 Extreme value treatment

Top cuts of extreme grade values prevent over-estimation in domains due to disproportionately high grade samples. Whenever the domain contains an extreme grade value, this extreme grade will overly influence the estimated grade.

If the extreme values are supported by surrounding data, are a valid part of the sample population, and are not considered to pose a risk to estimation quality, then they can be left untreated. If the extreme values are not considered to be a valid part of the population (e.g., they belong in another domain or are simply erroneous), they should be removed from the domains data set. If the extreme values are considered a valid part of the population but are considered to pose a risk for estimation quality (e.g., because they are poorly supported by neighboring values), they should be top cut. Top cutting is the practice of resetting all values above a certain threshold value to the threshold value.

Fortuna examined the grades of all metals to be estimated (Ag, Pb, Zn, and Au) to identify the presence and nature of extreme grade values. This was done by examining the sample histogram, log histogram, log-probability plot, and by examining the spatial location of extreme values. Top cut thresholds were determined by examination of the same statistical plots and by examination of the effect of top cuts on the mean, variance, and coefficient of variation (CV) of the sample data. Top cut thresholds used for each vein are shown in Table 14.5.

**Table 14.5 Topcut thresholds by vein**

Vein	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
Animas	3,500	10	25	25
Animas (splay)	3,500	10	30	25
Animas NE	1,000	3.3	35	27
Animas NE (splay)	1,200	4	28	24
Bateas & Bateas Splay	10,000	7	6	9
Bateas Techo	1,200	2	-	1
Bateas Piso (High grade)	12,000	4	2.1	3.2
Bateas Piso (Low grade)	200	0.2	0.3	0.5
Silvia	550	6	12	17
Soledad	6,500	40	11	16
Santa Catalina	1,500	15	11	13
Patricia	550	5	-	-
Pilar	550	6	-	-
La Plata (High grade)	11,000	25	0.2	0.2
La Plata (Low grade)	200	4	0.05	0.2



Vein	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
Cimoide La Plata	10,000	60	-	-
San Cristóbal	900	55	-	-
Paralela	4,000	2.5	-	-
San Carlos	3,000	18	-	-
San Pedro	8,000	20	-	-
Nancy	-	5.5	12	15
Ramal Piso Carolina	1,000	15	0.6	1
Don Luis II	-	15	1	2

#### 14.6.5 Boundary conditions

The boundary conditions at Caylloma are well established with underground workings identifying a sharp contact between the mineralized vein structure and the host rock in all veins. Subsequently domain boundaries were treated as hard boundaries. Only samples coded within a vein were used to estimate blocks within that vein, to prevent smearing of high grade samples in the vein into the low grade host rock, and vice versa.

The boundary conditions between oxide and sulfide material in the Animas/Animas NE veins is gradational in nature occurring over tens of meters. This boundary has been treated as a soft boundary with samples from either domain being used for estimation in the vein. This allows a gradational effect in the grade estimates.

The boundary between high and low grade areas is also treated as gradational, but to prevent high grades smearing into low grade areas only low grades are used to estimate blocks in the low grade area, whereas all samples are used to estimate the high grade regions.

#### 14.6.6 Data declustering

Descriptive statistics of sample populations within a domain may be biased by clustering of sample data in particular areas of the domain. To reduce any bias caused by clustering of sample data, Fortuna declustered the input sample data using a grid system. Declustered data statistics are used when comparing estimated grade values and input sample grades during model validation.

#### 14.6.7 Sample type comparison

A comparison between drill hole and channel samples was conducted, comparing the different sampling types over a similar spatial coverage. The results showed a bias indicating that grades returned from channel samples on average tend to return higher values compared to grades from drill core samples.

However, in the majority of cases channel samples are clustered around historical and present day workings, whereas drilling is focused on exploring the periphery of the veins and is therefore generally located away from the workings so finding examples where they share the same spatial coverage is difficult.

The estimation predominately uses channel samples with drill hole samples generally only used to infer resources at the edge of the mineralized envelopes. Both sample types are required to provide a reasonable assessment of the deposit with reconciliation results supporting the usage of channels and drill holes.



## 14.7 Variogram analysis

### 14.7.1 Continuity analysis

Continuity analysis refers to the analysis of the spatial correlation of a grade value between sample pairs to determine the major axis of spatial continuity.

The grade distribution has a log-normal distribution therefore traditional experimental variograms tended to be poor in quality. To counteract this, data was transformed into a normal score distribution for continuity analysis.

Horizontal, across strike, and down dip continuity maps were examined (and their underlying variograms) for Ag, Au, Pb, and Zn to determine the directions of greatest and least continuity. As each vein has a distinct strike and dip direction analysis was only required to ascertain if a plunge direction was present.

Continuity analysis confirmed that some veins have insufficient data to allow variogram modeling, including the Patricia, Pilar, Paralela, San Cristóbal, Nancy, San Carlos, San Pedro, Ramal Piso Carolina, Don Luis II and any splay veins. In the case of these veins inverse power of distance was used as an alternative estimation technique.

### 14.7.2 Variogram modeling

The next step is to model the variograms for the major, semi-major, and minor axes. This exercise creates a mathematical model of the spatial variance that can be used by the ordinary kriging algorithm. The most important aspects of the variogram model are the nugget effect and the short range characteristics. These aspects have the most influence on the estimation of grade.

The nugget effect is the variance between sample pairs at the same location (zero distance). Nugget effect contains components of inherent variability, sampling error, and analytical error. A high nugget effect implies that there is a high degree of randomness in the sample grades (i.e., samples taken even at the same location can have very different grades). The best technique for determining the nugget effect is to examine the downhole variogram calculated with lags equal to the composite length.

After determining the nugget effect, the next step is to model directional variograms in the three principal directions for Ag, Au, Pb, and Zn based on the directions chosen from the variogram fans. It was not always possible to produce a variogram for the minor axes, and in these cases the ranges for the minor axes were taken from the downhole variograms, which have a similar orientation (perpendicular to the vein) as the minor axes. Modeled variograms were back transformed from normal score as grade estimation is conducted without data manipulation (Table 14.6).

**Table 14.6 Variogram model parameters**

Vein	Metal	Major axis orientation	C <sub>0</sub> <sup>§</sup>	C <sub>1</sub> <sup>§</sup>	Ranges (m) <sup>†</sup>	C <sub>2</sub> <sup>§</sup>	Ranges (m) <sup>†</sup>	C <sub>3</sub> <sup>§</sup>	Ranges (m) <sup>†</sup>
<b>Animas</b>	Ag	-44° → 164°	0.42	0.23	14,12,5	0.15	31,29,11	0.20	262,250,18
	Au	-44° → 164°	0.43	0.29	9,10,5	0.23	44,30,6	0.06	80,128,10
	Pb	-44° → 164°	0.32	0.13	10,7,5	0.21	27,21,11	0.34	184,105,17
	Zn	-44° → 164°	0.26	0.16	13,9,3	0.24	47,28,13	0.34	300,500,9999
<b>Animas NE</b>	Ag	-45° → 155°	0.38	0.23	16,21,5	0.21	53,58,8	0.17	200,202,11
	Au	-45° → 155°	0.43	0.13	5,6,4	0.25	22,35,9	0.19	9999,159,12
	Pb	-45° → 155°	0.29	0.30	14,13,3	0.25	61,37,8	0.15	140,220,10
	Zn	-45° → 155°	0.33	0.32	14,16,3	0.19	52,47,9	0.15	9999,500,10



Vein	Metal	Major axis orientation	C <sub>0</sub> <sup>§</sup>	C <sub>1</sub> <sup>§</sup>	Ranges (m) <sup>†</sup>	C <sub>2</sub> <sup>§</sup>	Ranges (m) <sup>†</sup>	C <sub>3</sub> <sup>§</sup>	Ranges (m) <sup>†</sup>
<b>Bateas</b>	Ag	-69° → 227°	0.37	0.29	13,12,1	0.24	46,36,4	0.10	56,9999,5
	Au	-69° → 227°	0.55	0.19	6,6,3	0.11	20,20,8	0.15	95,52,14
	Pb	-69° → 227°	0.26	0.26	9,12,1	0.32	39,38,4	0.16	220,220,6
	Zn	-69° → 227°	0.25	0.29	13,10,2	0.31	46,42,4	0.15	180,180,6
<b>Silvia</b>	Ag	00° → 250°	0.31	0.4	7,10,2	0.28	25,24,4		
	Au	00° → 250°	0.57	0.3	10,7,2	0.14	28,20,3		
	Pb	00° → 250°	0.26	0.44	6,5,2	0.29	17,24,3		
	Zn	00° → 250°	0.33	0.37	7,10,3	0.29	77,20,4		
<b>Soledad</b>	Ag	00° → 250°	0.3	0.25	6,4,3	0.24	21,26,4	0.21	197,78,5
	Au	00° → 250°	0.39	0.19	8,5,2	0.17	15,19,4	0.25	150,120,5
	Pb	00° → 250°	0.28	0.3	9,8,1	0.15	15,16,2	0.26	59,41,3
	Zn	00° → 250°	0.24	0.25	7,5,1	0.22	15,15,2	0.29	77,46,3
<b>Santa Catalina</b>	Ag	00° → 250°	0.46	0.19	7,6,2	0.11	16,18,3	0.24	130,56,4
	Au	-60° → 340°	0.34	0.35	6,6,2	0.13	18,14,5	0.17	64,60,7
	Pb	-60° → 340°	0.23	0.31	6,7,1	0.18	13,20,2	0.27	69,34,3
	Zn	00° → 250°	0.16	0.25	6,5,2	0.23	15,26,4	0.37	100,41,6
<b>La Plata</b>	Ag	-60° → 155°	0.32	0.18	55,6,4	0.5	94,80,6		
	Au	00° → 245°	0.52	0.29	12,4,4	0.19	15,9,6		
<b>Cimoide La Plata</b>	Ag	00° → 245°	0.42	0.36	5,7,3	0.21	33,13,5		
	Au	-55° → 155°	0.35	0.44	43,6,7	0.21	57,15,12		
Note: <sup>§</sup> variances have been normalised to a total of one; <sup>†</sup> ranges for major, semi-major, and minor axes, respectively; structures are modelled with a spherical model									

## 14.8 Modeling and estimation

### 14.8.1 Block size selection

Block size was selected principally based on drill hole spacing, mineralized domain geometry, and the proposed mining method. Quantitative Kriging Neighborhood Analysis (QKNA) was also used to assess the optimum block size based on Kriging Efficiency (KE) and slope of regression (ZZ) in the veins where variogram models had been established (Animas, Animas NE, Bateas, Santa Catalina, Silvia, Soledad, and La Plata). Results were assessed from a centroid likely to be mined in the next 12 months.

The objective of QKNA is to determine the optimal combination of search neighborhood and block size that limits conditional bias and, subsequently provides the best possible estimation with the available data (Vann et al, 2003).

The slope of regression is a measure of the regression between the theoretical actual and estimated values for blocks. The values should be from 0 to 1. Values close to one indicate low conditional bias (a better result).

Kriging efficiency indicates the degree of smoothing (averaging) in the estimation. Values close to 100 percent are not smoothed and values close to 0 percent are highly smoothed. Where the kriging efficiency is negative, the global mean is considered a better estimate of grade than the kriged estimate.

In conjunction with the QKNA process, the veins geometry and the size of the equipment used in extraction are also considered. The narrow and undulating nature of the vein is a justification to subdivide the blocks into smaller subcells. This ensures the

block model is volumetrically representative. The incremental block sizes selected for each vein are detailed in Table 14.7

### 14.8.2 Block model parameters

Vein structures are generally orientated in a northeast to southwest direction. Such an orientation can be problematic when filling the vein wireframes with blocks as these are orientated orthogonally which can result in large discrepancies in volumes. To counteract this each vein has been rotated so that the strike direction of the vein is orientated in an orthogonal direction (i.e. east to west) for block modeling. Splitting of the parent blocks was allowed to ensure a close fit to the wireframe, although estimation was applied to parent cells only (all sub-cells in a parent cell have the same grade). To ensure a successful estimation the drill hole and channel composites were also rotated to coincide with the veins. Table 14.7 gives the block model parameters for the 2014 Caylloma Mineral Resource models with coordinates using the WGS84, UTM Zone 19S system prior to rotation.

Each vein has been block modeled separately with care taken to ensure that overlapping blocks do not exist. Additional to this each block in the vein has been coded using the field name "TIPO" (Type) as being either oxide (OX) sulfide (SR) or internal waste (RD). This code corresponds to that assigned to the sample data and has been used for estimation and reporting purposes.

**Table 14.7 Caylloma block model parameters by vein**

Vein	Rotation	Direction	Minimum	Maximum	Increment (m)
<b>Animas</b>	53	X	193200	194475	4
		Y	8317000	8318136	2
		Z	4310	4940	2
<b>Animas NE</b>	72	X	194395	195800	4
		Y	8317579	8319150	2
		Z	4310	4821	2
<b>Bateas</b>	70	X	192890	193750	6
		Y	8319894	8320290	1
		Z	4390	4830	2
<b>Bateas Piso</b>	70	X	193173	193450	6
		Y	8320060	8320220	1
		Z	4580	4829	2
<b>Bateas Techo</b>	70	X	193089	193474	6
		Y	8319983	8320044	1
		Z	4457	4740	2
<b>Silvia</b>	85	X	194710	194800	8
		Y	8320195	8320290	1
		Z	4551	4973	6
<b>Soledad</b>	73	X	194300	195100	8
		Y	8320232	8320550	1
		Z	4611	4899	6
<b>Santa Catalina</b>	67	X	194455	194805	5
		Y	8320495	8320655	1
		Z	4640	4775	5



Vein	Rotation	Direction	Minimum	Maximum	Increment (m)
Patricia	75	X	194340	194870	8
		Y	8320325	8320510	1
		Z	4650	4850	6
Pilar	75	X	194300	194710	8
		Y	8320150	8320325	1
		Z	4600	4965	6
La Plata	60	X	193850	195300	6
		Y	8316799	8318144	1
		Z	4500	4867	6
Cimoide La Plata	60	X	194000	194490	6
		Y	8317052	8317515	1
		Z	4551	4827	6
San Cristobal	45	X	194826	194	8
		Y	8320946	8321050	1
		Z	4520	4950	8
Paralela	45	X	192869	193060	6
		Y	8321790	8322056	1
		Z	4510	4677	6
San Carlos	50	X	192595	193055	6
		Y	8320752	8321039	1
		Z	4601	4772	6
San Pedro	60	X	192748	193558	6
		Y	8321829	8322740	1
		Z	4516	4646	6
Nancy	10	X	195431	195801	4
		Y	8318900	8319175	2
		Z	4390	4697	6
Ramal Piso Carolina	105	X	193200	193800	6
		Y	8321978	8322155	2
		Z	4531	4879	4
Don Luis II	110	X	190800	191300	6
		Y	8319484	8319796	2
		Z	4500	4904	4

### 14.8.3 Sample search parameters

Quantitative kriging neighborhood analysis (QKNA) was undertaken on the Caylloma veins to determine the optimal search parameters for the Mineral Resource estimates. This study, which was consistent with Fortuna's experience with the deposit, showed that the best estimation results in terms of slope of regression, kriging efficiency, and kriging variance were obtained using the following search strategy:

- A search range of approximately 20 m to 30 m along strike and down dip and 2 m to 5 m across the vein
- A minimum of 10 composites and maximum of 20 composites per estimate
- A maximum of 2 or 3 samples from a single channel or drill hole

The search ellipsoid used to define the extents of the search neighborhood has the same orientation as the continuity directions observed in the variograms.

Distances used were designed to match the configuration of the drill hole data (i.e., areas of sparse drilling have larger ellipses than more densely drilled or sampled areas). This was achieved by using a dynamic search ellipsoid where a second search equal to two times the maximum variogram range and requiring a minimum of six composites was used wherever the first search did not encounter enough samples to perform an estimate; if enough samples were still not encountered, a third search equal to three times the primary search range and requiring one composite was used. The exception to this was for the Bateas, Nancy, Ramal Piso Carolina and Don Luis II veins that used a third search ellipse four times the primary search range with a minimum of three composites; and the Animas NE vein that used a third search ellipse equal to five times the primary search ellipse with a minimum of three composites. The larger search ellipses were used in cases where peripheral sample numbers were low and using a single composite for estimation purposes was problematic. For blocks where the minimum number of samples required was not encountered, no estimate was made.

#### 14.8.4 Grade interpolation

Estimation of grades into blocks was performed using either ordinary kriging (OK) or inverse power of distance (Table 14.8) based on the success of generating a variogram model.

**Table 14.8 Estimation method by vein**

<b>Vein</b>	<b>Estimation Method</b>
<b>Animas</b>	Ordinary Kriging*
<b>Animas (Splay)</b>	Inverse Power of Distance (power=2)
<b>Animas NE</b>	Ordinary Kriging*
<b>Animas NE (Splay)</b>	Inverse Power of Distance (power=2)
<b>Bateas</b>	Ordinary Kriging*
<b>Bateas (Splay)</b>	Ordinary Kriging*
<b>Bateas Piso</b>	Inverse Power of Distance (power=2)
<b>Bateas Techo</b>	Ordinary Kriging*
<b>Silvia</b>	Ordinary Kriging*
<b>Soledad</b>	Ordinary Kriging*
<b>Soledad (Splay)</b>	Inverse Power of Distance (power=2)
<b>Santa Catalina</b>	Ordinary Kriging*
<b>Patricia</b>	Inverse Power of Distance (power=2)
<b>Pilar</b>	Inverse Power of Distance (power=2)
<b>La Plata</b>	Inverse Power of Distance (power=2)
<b>Cimoide La Plata</b>	Ordinary Kriging*
<b>San Cristóbal</b>	Inverse Power of Distance (power=2)
<b>Paralela</b>	Inverse Power of Distance (power=2)
<b>San Carlos</b>	Inverse Power of Distance (power=2)
<b>San Pedro</b>	Inverse Power of Distance (power=2)
<b>Nancy</b>	Inverse Power of Distance (power=2)
<b>Ramal Piso Carolina</b>	Inverse Power of Distance (power=2)
<b>Don Luis II</b>	Inverse Power of Distance (power=2)
*Lead and zinc grades estimated by inverse power of distance (power=2)	

Parameters were derived from block size selection (Section 14.8.1), search neighborhood optimization (Section 14.8.3), and variogram modeling (Section 14.7.2). The sample data were composited (Section 14.6.1) and, where necessary, top cut



(Section 14.6.4) prior to estimation. The sample data and the blocks were categorized into mineralized domains for the estimation (Section 14.6.3). Each block is discretized (an array of points to ensure grade variability is represented within the block) into 4 points along strike by 4 points down dip by 2 points across strike and grade interpolated into parent cells (Datamine ESTIMA parameter PARENT=1).

Due to the variable lengths of the composites a weighting system has been employed to nullify this volume variance issue when estimating into the three-dimensional block models, which involves the following steps: -

1. Generation of a grade aggregate in the sample file by multiplying the grade of the composite by its length
2. Estimation of the grade aggregate into the block model using the parameter files detailed above
3. Estimation of the composite length into the block model by inverse distance weighting (power = 2) using the same search and estimation parameters as were used to estimate the grade aggregate
4. Estimated aggregate grades are divided by the corresponding composite length estimate to provide the final grade

This procedure was employed for the previous Mineral Resource estimates and reconciliation results indicated a positive result. The methodology has therefore been maintained for the 2015 Mineral Resource update.

#### 14.8.5 Density

There has been a total of 4,121 density measurements taken by Minera Bateas as of June 30, 2015. Of these, 3,744 were taken from underground and 377 from drill core. Density analysis was performed on each vein separately with ten samples regarded as the minimum to ensure representative statistics. Extreme values that were thought not to be representative of the sample population were discarded reducing the total density measurement numbers used in the analysis to 3,901 (Table 14.9).

**Table 14.9 Density statistics by vein**

Vein	No. of samples	Mean (t/m <sup>3</sup> )	Minimum	Maximum	Variance
Animas (Sulfide)	1,648	<b>3.09</b>	2.27	3.91	0.11
Animas (Oxide)	91	<b>2.59</b>	1.76	3.43	0.14
Animas NE	862	<b>3.21</b>	2.49	4.00	0.10
Bateas	554	<b>3.01</b>	2.52	3.54	0.06
Bateas Techo	8	<b>2.67</b>	2.43	2.97	0.03
Silvia	88	<b>3.32</b>	2.57	4.19	0.13
Soledad	328	<b>3.09</b>	2.49	3.84	0.10
Santa Catalina	17	<b>3.13</b>	2.52	3.63	0.09
Pilar	6	<b>3.14</b>	2.89	3.37	0.03
La Plata	41	<b>2.59</b>	2.33	2.76	0.01
San Cristóbal	42	<b>2.75</b>	2.54	3.09	0.02
Nancy	54	<b>2.61</b>	2.13	3.26	0.06
Carolina & Ramal Piso Carolina	116	<b>2.55</b>	2.29	2.89	0.01
Don Luis II	46	<b>2.42</b>	2.03	2.76	0.03

Due to the insufficient spatial coverage of density measurements, estimation was regarded as being inappropriate. Subsequently each veins mean density value has been applied to all blocks in that vein with the exception of the Animas vein. Sufficient density measurements are available in the Animas vein to reveal a trend of increasing density with depth. Based on these statistics a variable density was assigned to the Animas vein based on depth (Table 4.10).

In respect to veins that have insufficient samples to determine the density the following was applied:

- In the cases where veins splayed, the same density was applied to the splay as was assigned to the main vein (i.e. Ramal Soledad assigned the same density as Soledad and Bateas Piso the same as the Bateas vein)
- A density of 3.33 t/m<sup>3</sup> was assigned to Patricia as this vein has a similar mineralogy to the Silvia vein
- Oxide material in Animas NE was assigned the same density as oxide material from Animas
- San Pedro, San Carlos, and Paralela were assigned a density of 3.0 t/m<sup>3</sup>, being the global average density for all veins

Density measurements assigned in the 2015 Mineral Resource update are detailed in Table 14.10.

**Table 14.10 Density assigned in the 2015 estimation update**

<b>Vein</b>	<b>Density assigned for 2015 estimate (t/m<sup>3</sup>)</b>
Animas (Sulfide)	
Elevation > 4800	2.76
Elevation > 4755 and < 4800	3.07
Elevation < 4755	3.18
Animas (Oxide)	2.59
Animas NE (Sulfide)	3.21
Animas NE (Oxide)	2.59
Bateas/Bateas Piso/Bateas Splay	3.01
Bateas Techo	2.67
Silvia	3.32
Soledad	3.09
Santa Catalina	3.13
Patricia	3.33
Pilar	3.14
La Plata	2.59
Cimoide La Plata	2.59
San Cristóbal	2.75
Paralela	3.00
San Carlos	3.00
San Pedro	3.00
Nancy	2.61
Ramal Piso Carolina	2.55
Don Luis II	2.42



## 14.9 Model validation

The techniques for validation of the estimated tonnes and grades included visual inspection of the model and samples in plan, section, and in three-dimensions; cross-validation; global estimate validation through the comparison of declustered sample statistics with the average estimated grade per domain; and local estimate validation through the generation of slice validation (swath) plots.

### 14.9.1 Cross validation

In defining the modeled variograms, estimation and search neighborhoods there are a range of potential values that can be set. In order to optimize these values cross validation, or jack-knifing, was performed. This technique involves excluding a sample point and estimating a grade in its place using the remaining composites. This process is repeated for all the composites being used for estimation and the average estimated grade is compared to the actual average grade of the composites.

Using this methodology, a variety of estimation techniques, search neighborhoods and variographic models were tested to establish the parameters that provided the most accurate result. Table 14.11 displays the estimated mean values for each element in each vein, as compared to the composite mean.

**Table 14.11 Cross validation results by vein**

Vein	Ag (g/t)		Au (g/t)		Pb (%)		Zn (%)	
	Composite	Estimate	Composite	Estimate	Composite	Estimate	Composite	Estimate
Animas	143	144	0.42	0.43	1.83	1.84	3.20	3.22
Animas NE	110	110	0.28	0.28	3.31	3.32	4.25	4.27
Bateas	801	805	0.19	0.19	0.56	0.56	0.85	0.86
Bateas Piso	1,419	1,445	0.49	0.49	0.30	0.30	0.54	0.54
Bateas Techo	194	196	0.20	0.21	0.06	0.06	0.03	0.03
Bateas Splay	948	958	0.39	0.39	0.73	0.73	1.35	1.36
La Plata (High grade)	1,842	1,862	2.29	2.31	0.015	0.013	0.02	0.02
La Plata (Low grade)	158	204	0.27	0.36	0.07	0.09	0.37	0.49
Cimoide La Plata	446	443	2.10	2.13	0.01	0.01	0.02	0.02
Soledad	421	420	2.22	2.21	1.33	1.33	1.69	1.69
Silvia	87	87	0.42	0.42	1.70	1.70	2.57	2.57
Ramal Piso Carolina	118	110	4.66	4.82	0.05	0.05	0.09	0.08
Don Luis II	334	411	3.63	4.87	0.07	0.07	0.15	0.12
Santa Catalina	135	135	1.01	1.01	1.64	1.66	2.42	2.42
Patricia	165	182	0.66	0.66	0.52	0.56	0.70	0.71
Pilar	114	113	1.18	1.21	0.54	0.54	0.58	0.60
San Cristóbal	209	210	0.23	0.23	0.09	0.09	0.16	0.16
Paralela	278	279	0.08	0.06	0.20	0.16	0.59	0.46
San Carlos	369	388	0.11	0.11	0.00	0.00	0.01	0.01
San Pedro	506	504	0.34	0.35	0.00	0.00	0.00	0.00

### 14.9.2 Global estimation validation

Global validation of the estimate involves comparing the mean ordinary kriged grade for each vein against the mean declustered grade generated using a nearest neighbor (NN) estimation approach. Analysis was performed by classification to ensure low confidence areas do not distort the results from higher confidence regions (Table 14.12, Table 14.13, and Table 14.14).





**Table 14.12 Global validation statistics of Measured Resources at a zero cut-off grade (COG)**

Vein	Ag (g/t)			Au (g/t)			Pb (%)			Zn (%)		
	OK-Ac	NN	Diff (%)	OK-Ac	NN	Diff (%)	OK-Ac	NN	Diff (%)	OK-Ac	NN	Diff (%)
Animas	146	146	-0.1	0.40	0.40	0.4	1.58	1.56	-1.3	2.83	2.80	-1.1
Animas NE	104	108	4.0	0.27	0.28	3.2	3.18	3.23	1.7	3.93	3.94	0.3
Bateas	750	763	1.7	0.20	0.18	-9.4	0.56	0.58	2.7	0.85	0.87	2.7
Bateas Piso	886	947	6.8	0.29	0.26	-10.9	0.19	0.20	8.4	0.33	0.36	9.7
Bateas Splay	410	279	-31.9	0.14	0.11	-22.0	0.28	0.20	-28.3	0.59	0.41	-29.6
Silvia	92	91	-1.1	0.36	0.38	5.6	1.75	1.75	0.0	2.64	2.71	2.7
Soledad	346	327	-5.5	1.86	1.87	0.5	1.21	1.2	-0.8	1.56	1.55	-0.6
Santa Catalina	134	138	3.0	1.12	1.09	-2.7	1.63	1.74	6.7	2.37	2.38	0.4

The results for blocks classified as Measured are regarded as reasonable, with differences being generally less than 5 percent. Differences greater than 5 percent are due to either the over-estimation of the nearest neighbor grade due to the presence of isolated high grade composites or due to low overall grade concentrations. The results for the Bateas splay are poor but this is due to the very small tonnage of Measured material for this vein and is therefore not a concern.

**Table 14.13 Global validation statistics of Indicated Resources at a zero COG**

Vein	Ag (g/t)			Au (g/t)			Pb (%)			Zn (%)		
	OK-Ac	NN	Diff (%)	OK-Ac	NN	Diff (%)	OK-Ac	NN	Diff (%)	OK-Ac	NN	Diff (%)
Animas	70	66	-4.9	0.27	0.27	-2.2	1.21	1.17	-3.3	2.41	2.30	-4.6
Animas NE	72	76	6.2	0.21	0.21	-0.7	2.67	2.86	7.0	3.35	3.61	7.6
Bateas	205	201	-2.1	0.08	0.08	8.3	0.22	0.21	-2.9	0.35	0.35	0.3
Bateas Piso	291	267	-8.5	0.12	0.10	-19.1	0.06	0.05	-14.9	0.09	0.09	-2.1
Bateas Splay	245	182	-25.8	0.16	0.11	-29.7	0.14	0.08	-40.7	0.36	0.23	-36.3
Bateas Techo	127	123	-3.2	0.10	0.12	20.5	0.05	0.04	-5.6	0.04	0.04	-4.1
La Plata (High)	1,544	1,157	-25.1	1.96	1.45	-25.9	0.03	0.03	18.0	0.01	0.02	54.3
Silvia	70	65	-7.1	0.58	0.72	24.1	1.07	1.00	-6.5	2.00	2.02	1.0
Soledad	180	164	-8.9	1.36	1.68	23.5	1.07	1.07	0.0	1.38	1.39	0.7
Santa Catalina	81	73	-9.9	0.55	0.44	-20.0	0.95	0.81	-14.7	1.46	1.31	-10.3
Cimoide La Plata	390	351	-9.9	1.98	1.31	-33.9	-	-	n/a	-	-	n/a

Results for blocks classified as Indicated and Inferred are also regarded as reasonable. Any large discrepancies (>10 percent) were investigated and were generally attributed to low tonnages or isolated higher grade values.

**Table 14.14 Global validation statistics of Inferred Resources at a zero COG**

Vein	Ag (g/t)			Au (g/t)			Pb (%)			Zn (%)		
	OK-Ac	NN	Diff (%)	OK-Ac	NN	Diff (%)	OK-Ac	NN	Diff (%)	OK-Ac	NN	Diff (%)
Animas	39	38	-2.2	0.19	0.18	-8.0	0.92	0.86	-6.3	1.93	1.85	-4.3
Animas NE	63	57	-9.4	0.16	0.14	-12.8	1.76	1.82	3.4	2.07	2.22	7.2
Bateas	219	223	1.7	0.09	0.10	19.3	0.17	0.17	1.6	0.27	0.30	11.8
Bateas Piso	218	211	-2.8	0.09	0.08	-11.2	0.06	0.04	-24.7	0.11	0.09	-19.2
Bateas Splay	365	240	-34.1	0.30	0.12	-61.4	0.19	0.13	-29.7	0.61	0.39	-35.6
Bateas Techo	117	117	0.1	0.13	0.12	-4.8	0.02	0.02	-6.3	0.03	0.03	-2.4
La Plata (High)	221	133	-39.7	0.84	0.81	-3.9	0.02	0.03	2.9	0.07	0.07	2.1

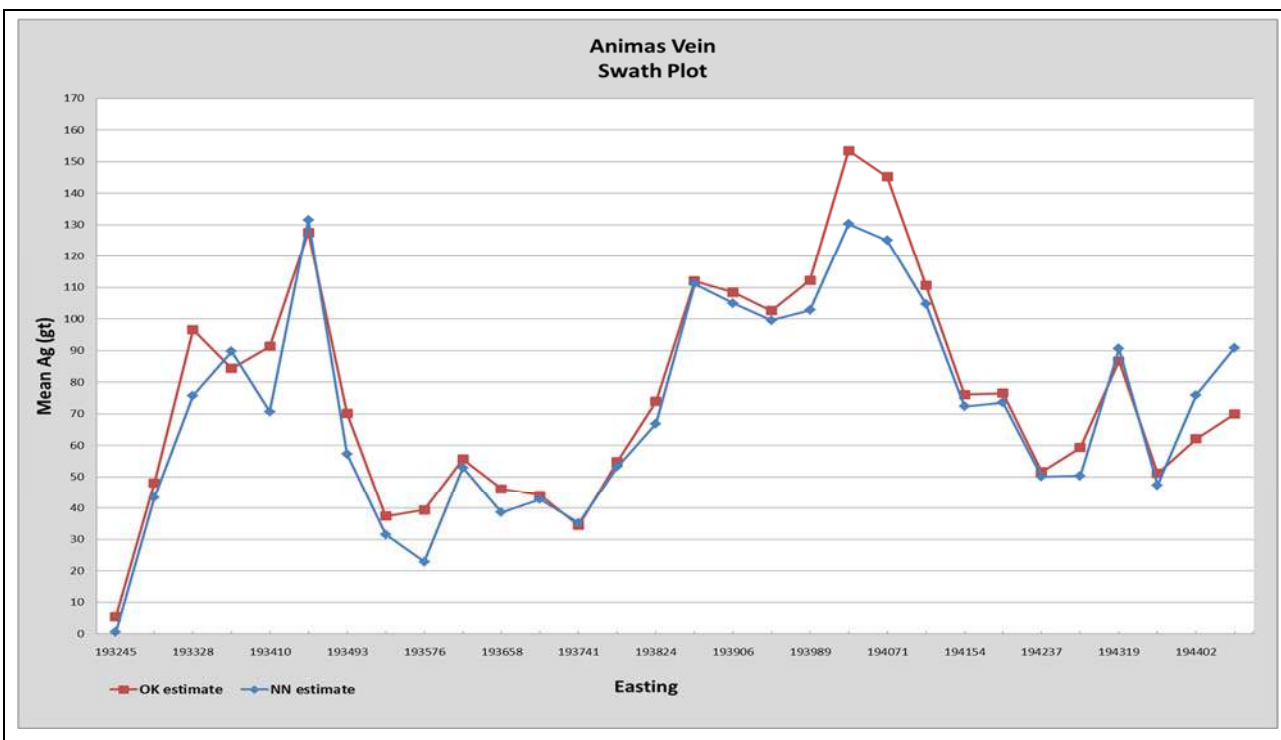


Vein	Ag (g/t)			Au (g/t)			Pb (%)			Zn (%)		
	OK-Ac	NN	Diff (%)	OK-Ac	NN	Diff (%)	OK-Ac	NN	Diff (%)	OK-Ac	NN	Diff (%)
La Plata (Low)	174	134	-23.1	0.27	0.26	-4.0	0.10	0.10	-2.4	0.52	0.51	-0.5
Silvia	60	60	0.0	0.70	0.51	-27.1	0.74	0.63	-14.9	1.43	1.33	-7.0
Soledad	99	85	-14.1	0.62	0.83	33.9	0.62	0.56	-9.7	1.06	1.12	5.7
Santa Catalina	53	59	11.3	0.24	0.24	0.0	0.43	0.38	-11.6	0.65	0.64	-1.5
Patricia	148	148	0.0	0.62	0.56	-9.7	0.35	0.33	-5.7	0.51	0.48	-5.9
Pilar	156	168	7.7	1.38	1.43	3.6	0.43	0.49	14.0	0.37	0.39	5.4
Cimoide La Plata	145	185	27.3	0.76	0.69	-9.0	-	-	n/a	-	-	n/a
San Cristobal	205	194	-5.4	0.36	0.36	0.0	0.13	0.11	-15.4	0.27	0.23	-14.8
Paralela	410	452	10.2	0.39	0.31	-20.5	0.17	0.12	-29.4	0.50	0.39	-22.0
San Carlos	353	393	11.3	0.14	0.06	-57.1	0.04	0.04	0.0	0.22	0.21	-4.5
San Pedro	583	657	12.7	2.02	2.48	22.8	-	-	n/a	-	-	n/a
Nancy	67	68	1.5	0.64	0.54	-15.6	2.35	2.39	1.7	2.14	2.19	2.3
Ramal Piso Carolina	122	140	14.8	3.85	4.06	5.5	0.05	0.06	20.0	0.08	0.10	25.0
Don Luis II	316	260	-17.7	0.89	0.82	-7.9	0.04	0.03	-25.0	0.07	0.07	0.0

### 14.9.3 Local estimation validation

Slice validation plots of estimated block grades and declustered input sample grades were generated for each of the veins by easting, northing, and elevation to validate the estimates on a local scale. Validation of the local estimates assesses each model to ensure over-smoothing or conditional bias is not being introduced by the estimation process and an acceptable level of grade variation is present. An example slice (or swath) plot for Animas is displayed in Figure 14.1.

Figure 14.1 Slice validation plot of the Animas vein



The slice plots display a good continuity between the ordinary kriged estimates and declustered nearest neighbor estimates indicating that the kriging is not over-smoothing. Areas that do not have a good correlation, such as the far west of the Animas vein are related to areas where sample numbers are limited. Based on the above results it was concluded that ordinary kriging was a suitable interpolation method and provided reasonable global and local estimates of all economical metals.

#### 14.9.4 Mineral Resource reconciliation

The ultimate validation of the block model is to compare actual grades to predicted grades using the established estimation parameters. Evaluation of the mineral in-situ from channel samples taken from July 1, 2014 to December 31, 2015 provided an estimation of the actual grades. In order to test the ability of the estimation process to predict grades in areas that channel sampling had yet to be performed all samples collected after June 2014 were filtered from the database and the estimation run using the remaining samples. The results of this evaluation are displayed in Table 14.15.

**Table 14.15 Reconciliation of the Mineral Resource estimate against Mineral In-situ extracted between July 1, 2014 and December 31, 2015**

Vein	Mineral In Situ					Block Model					Error (%)				
	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Tonnes	Ag	Au	Pb	Zn
<b>Q3-4 2014</b>	205,811	208	0.29	2.02	3.54	200,701	207	0.29	2.18	3.69	<b>2</b>	<b>0</b>	<b>-2</b>	<b>-8</b>	<b>-4</b>
<b>Q1-2 2015</b>	161,736	195	0.28	2.34	3.94	156,700	215	0.31	2.41	4.21	<b>3</b>	<b>-10</b>	<b>-10</b>	<b>-3</b>	<b>-7</b>
<b>Q3-4 2015</b>	172,978	168	0.29	4.56	5.76	157,400	170	0.31	4.27	5.54	<b>10</b>	<b>-1</b>	<b>-6</b>	<b>7</b>	<b>4</b>
<b>Total</b>	540,525	191	0.29	2.93	4.37	514,801	198	0.30	3.03	4.41	<b>5</b>	<b>-4</b>	<b>-5</b>	<b>1</b>	<b>-1</b>

The results suggest that the estimates are providing an excellent representation of what is being encountered underground during production. Estimated tonnes and grades are all within 10 percent of the actual indicating the parameters used in the estimation are suitable.

#### 14.9.5 Mineral Resource depletion

All underground development and stopes are regularly surveyed using Total Station methods at Caylloma as a component of monitoring the underground workings. The survey information is imported into Datamine and used to generate three dimensional solids defining the extracted regions of the mine. Each wireframe is assigned a date corresponding to when the material was extracted providing Minera Bateas a history of the progression of the mining since 2006.

The three dimensional solids are used to identify resource blocks that have been extracted and assign a code that corresponds to the date of extraction. Table 14.16 details the codes stored in the resource block model and the date ranges that they represent. Blocks with a ZONA (Zone) code of one or greater are excluded from the reported Mineral Resources.

**Table 14.16 Depletion codes stored in the resource block model**

<b>ZONA</b>	<b>Description</b>
<b>0</b>	Mineral In-situ (not extracted)
<b>1</b>	Mineral extracted prior to June 2014
<b>2</b>	Mineral extracted from July to December 2014
<b>3</b>	Mineral extracted from January to June 2015
<b>4</b>	Mineral extracted as developments (Galleries)
<b>5</b>	Mineral extracted from July to December 2015

Removal of extracted material often results in remnant resource blocks being left in the model that will likely never be exploited. These represent inevitable components of mining such as pillars and sills, or lower grade peripheral material that was left behind. To take account of this, areas were identified by the mine planning department as being fully exploited, and any remnant blocks within these areas were identified in the block model using the code “RM = 1” and excluded from the reported Mineral Resources.

## 14.10 Mineral Resource classification

Resource confidence classification considers a number of aspects affecting confidence in the Resource estimation, such as:

- Geological continuity (including geological understanding and complexity)
- Data density and orientation
- Data accuracy and precision
- Grade continuity (including spatial continuity of mineralization)
- Estimation quality

### 14.10.1 Geological continuity

There is substantial geological information to support a good understanding of the geological continuity at the Caylloma Property. Detailed surface mapping identifying vein structures are supported by extensive exploration drilling.

The Minera Bateas exploration geologists log drill core in detail including textural, alteration, structural, geotechnical, mineralization, and lithological properties, and continue to develop a good understanding of the geological controls on mineralization.

Understanding of the vein systems is greatly increased by the presence of extensive underground workings allowing detailed mapping of the geology. Underground observations have greatly increased the ability to accurately model the mineralization. The proximity of resources to underground workings has been taken into account during resource classification.

### 14.10.2 Data density and orientation

The estimation relies on two types of data, channel samples and drill holes. Minera Bateas has explored the Caylloma veins using a drilling pattern spaced roughly 50 m apart along strike. Each hole attempts to intercept the vein perpendicular to the strike of mineralization but this is rarely the case, with the actual intercept angle being between 70 to 90 degrees.

Exploration drilling data is supplemented by a wealth of underground information including channel samples taken at approximately 3 m intervals perpendicular to the strike of the mineralization. Geological confidence and estimation quality are closely related to data density and this is reflected in the classification of resource confidence categories.

#### **14.10.3 Data accuracy and precision**

Classification of resource confidence is also influenced by the accuracy and precision of the available data. The accuracy and the precision of the data may be determined through QAQC programs and through an analysis of the methods used to measure the data.

Analysis of standards and blanks for the Bateas laboratory indicate acceptable levels of accuracy for silver, lead, zinc, and gold grades. The results of the blanks submitted indicate that contamination or mislabeling of samples is not a material issue at the Bateas laboratory. Preparation and laboratory duplicates indicate acceptable levels of precision in the Bateas laboratory for silver, lead, zinc, and gold grades.

The high levels of accuracy and lack of contamination indicate that grades reported from the Bateas laboratory are suitable for Mineral Resource estimation.

Fortuna have been unable to verify the accuracy and precision of the CMA channel data used in the estimation of the Paralela, San Pedro, and San Carlos veins and therefore this has been taken into consideration during classification.

#### **14.10.4 Spatial grade continuity**

Spatial grade continuity, as indicated by the variogram, is an important consideration when assigning resource classification. Variogram characteristics strongly influence estimation quality parameters such as kriging efficiency and regression slope.

The nugget effect and short range variance characteristics of the variogram are the most important measures of continuity. For the Caylloma veins, the variogram nugget variance for Ag and Au is between 30 percent and 66 percent of the population variance, demonstrating the high variability of these precious metals. The variogram nugget variance for Pb and Zn is lower being between 16 percent and 35 percent. This shows that in general the lead and zinc grades have good continuity at short distances which results in a higher confidence in these estimated grades.

#### **14.10.5 Estimation quality**

Estimation quality is influenced by the variogram, the scale of the estimation, and the data configuration. Estimations of small volumes have poorer quality than estimations of large volumes. Measures such as kriging efficiency, kriging variance, and regression slope quantify the quality of local estimations.

Fortuna used the estimation quality measures to aid in assignment of Resource confidence classifications. The classification strategy has resulted in the expected progression from higher to lower quality estimates when going from Measured to Inferred Resources.

#### **14.10.6 Classification**

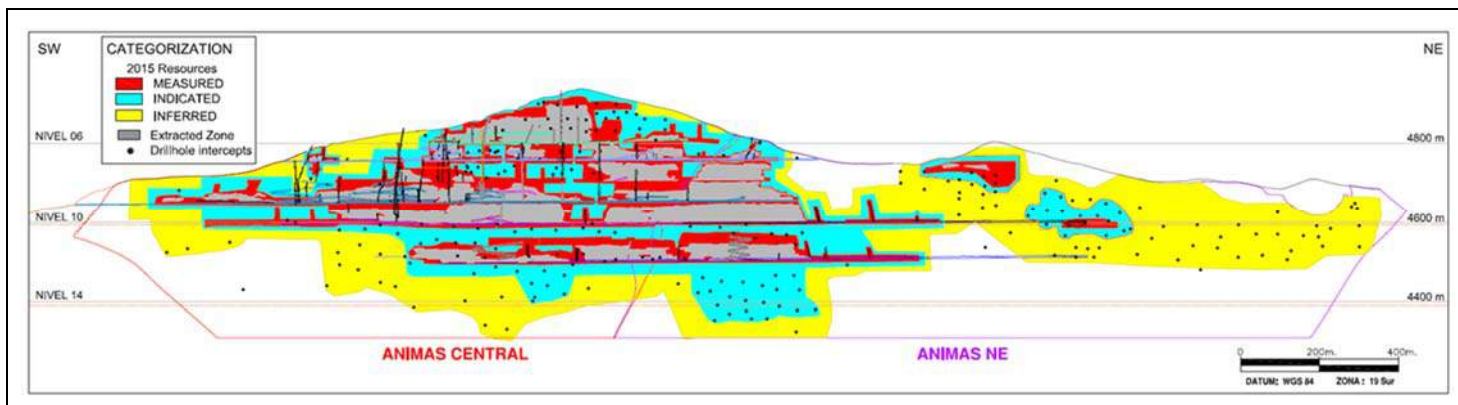
The Mineral Resource confidence classification of the Caylloma resource block models incorporated the confidence in the drill hole and channel data, the geological interpretation, geological continuity, data density and orientation, spatial grade

continuity, and estimation quality. The resource models were coded as Inferred, Indicated, and Measured in accordance with CIM standards. Classification was based on the following steps:

- Blocks estimated using primary search neighborhoods were considered for the Measured Resource category
- Blocks estimated using secondary search neighborhoods were considered for the Indicated Resource category
- Blocks estimated using tertiary search neighborhoods were considered as Inferred Resources
- Kriging efficiency (KE) and regression slope ( $ZZ$ ) values were assessed and the classification adjusted to take into account this information
- Perimeter strings were digitized in Datamine and the block model coded as either CAT=1 (Measured), CAT=2 (Indicated) or CAT =3 (Inferred) based on the above steps

The above criteria ensure a gradation in confidence with making it impossible that Inferred blocks are adjacent to Measured. It also ensures that blocks considered as Measured are informed from at least three sides, blocks considered as Indicated from two sides, and blocks considered as Inferred from one side. An example of a classified vein is provided in Figure 14.2.

**Figure 14.2 Longitudinal section showing Mineral Resource classification for the Animas vein**



## 14.11 Mineral Resource reporting

A net smelter return (NSR) for each metal was calculated to take into consideration the commercial terms for 2015, the average metallurgical recovery, average grade in concentrate and long term metal prices. In this way the value of all metals produced at the operation could be taken into account during Mineral Resource reporting.

Metallurgical parameters and concentrate characteristics have been based on historical recoveries observed in the plant by Minera Bateas in 2014.

Metal prices were defined by Fortuna's financial department based on standard industry long term predictions. The proposed metal prices were reviewed and agreed upon by

the company's Qualified Persons. Details of the values for each parameter used in the NSR determination are displayed in Table 14.17.

The cut-off value used for reporting Mineral Resources is based on average operating costs for the operation in 2015 determined by Fortuna's finance and operations departments. There are two methods of extraction based on the thickness of the vein and in 2015 this has been taken into consideration in setting the cut-off value for Mineral Resources.

Veins classified as wide, being on average greater than two meters, are amenable to extraction by semi-mechanized mining methods with a US\$50/t NSR cut-off value applied. Veins that were classified as wide included Animas, Animas NE, Nancy, and San Cristobal.

Veins classified as narrow, being on average less than two meters, are amenable to extraction by conventional mining methods with a US\$100/t NSR cut-off value applied. This factor was applied to all other vein structures including Bateas, Bateas Piso, Bateas Techo, La Plata, Cimoide La Plata, Soledad, Santa Catalina, Silvia, Ramal Piso Carolina, Paralela, San Carlos, San Pedro, Patricia, Pilar, and Don Luis II.

**Table 14.17 Parameters used in Net Smelter Return (NSR) estimation for sulfides and oxides**

ZINC and LEAD			
Item	Unit	Zinc	Lead
Concentrate			
<b>Metal Price (a)</b>	<b>US\$/t</b>	<b>2,300</b>	<b>2,150</b>
Concentrate grade (b)	%	50.84	51.17
Deduction	%	85	95
Minimum deduction	%	8	3
Payable grade (e)	%	42.84	48.17
<b>Payment per tonne (f)</b>	<b>US\$/t</b>	<b>985</b>	<b>1,036</b>
Smelting costs	US\$/t	-269	-215
Escalator1	US\$/t	-0.15	-0.15
Penalties	US\$/t	0	0
<b>Total Charges (g)</b>	<b>US\$/t</b>	<b>-269</b>	<b>-215</b>
<b>Concentrate value (h)</b>	<b>US\$/t</b>	<b>717</b>	<b>821</b>
<b>Met. recovery – (i)</b>	<b>%</b>	<b>89.9</b>	<b>92.6</b>
<b>Value – (j)</b>	<b>US\$/%</b>	<b>12.68</b>	<b>14.85</b>
Notes: $f = (a \times e)/100$ $h = (f - g)$ $j = ((h \times i)/(100 \times b))$			

GOLD and SILVER			
Item	Unit	Silver	Gold
<b>Metal Price (a)</b>	<b>US\$/oz</b>	<b>19</b>	<b>1,140</b>
Deduction (b)	%	95	95
Refining Charges (c)	US\$/oz	1.5	20
Value after Met. Recovery (d)	US\$/oz	16.06	450.78
Payable metal (e)	US\$/oz	15.26	428.24
<b>Met. recovery – (f)</b>	<b>%</b>	<b>84.5</b>	<b>39.5</b>
<b>Value – (h)</b>	<b>US\$/g</b>	<b>0.45</b>	<b>13.53</b>
Notes: $d = (a \times f)/100$ $e = (d \times b - (c \times f \times b))/100$ $h = e/31.1035$			

Mineral Resource estimates are reported as of December 31, 2015. Oxide Mineral Resources (Table 14.18) have been reported separately from sulfide Mineral Resources (Table 14.19).



**Table 14.18 Mineral Resources (Oxide) as of December 31, 2015**

Category	Vein	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
<b>Measured Resources</b>	Animas	83,000	183	0.37	0.99	1.59
	Animas NE	114,000	138	0.50	2.27	1.92
	<b>Total</b>	<b>197,000</b>	<b>157</b>	<b>0.45</b>	<b>1.73</b>	<b>1.78</b>
<b>Indicated Resources</b>	Animas	132,000	186	0.40	1.01	1.77
	Animas NE	184,000	130	0.50	3.17	2.31
	<b>Total</b>	<b>315,000</b>	<b>154</b>	<b>0.46</b>	<b>2.27</b>	<b>2.09</b>
<b>Measured + Indicated Resources</b>	<b>Total</b>	<b>512,000</b>	<b>155</b>	<b>0.45</b>	<b>2.06</b>	<b>1.97</b>
<b>Inferred Resources</b>	Animas	46,000	83	0.40	1.06	2.40
	Animas NE	283,000	99	0.30	3.77	3.89
	<b>Total</b>	<b>329,000</b>	<b>97</b>	<b>0.32</b>	<b>3.40</b>	<b>3.68</b>

## Notes on Mineral Resources

- Mineral Resources are as defined by CIM Definition Standards on Mineral Resources and Mineral Reserves 2010
- Mineral Resources and Mineral Reserves are estimated as of June 30, 2015 and reported as of December 31, 2015 taking into account production-related depletion for the period of July 1, 2015 through December 31, 2015
- Mineral Resources are inclusive of Mineral Reserves
- The estimate of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant issues
- Resources for veins classified as wide (Anima, Animas NE, Nancy, and San Cristobal) are reported above a NSR cut-off value of US\$50/t. Resources for veins classified as narrow (All other veins) are reported above a NSR cut-off value of US\$100/t
- Metal prices used in the NSR evaluation are US\$19/oz for silver, US\$1,140/oz for gold, US\$2,150/t for lead and US\$2,300/t for zinc
- Metallurgical recovery values used in the NSR evaluation are 84.5 % for silver, 39.5 % for gold, 92.6 % for lead, and 89.9 % for zinc
- Point metal values (taking into account metal price, concentrate recovery, smelter cost, metallurgical recovery) used for NSR evaluation of are US\$0.45/g for silver, US\$13.53/g for gold, US\$14.85/% for lead, and US\$12.68/% for zinc
- The quantity and grade of the Inferred Resources reported in this estimation are conceptual in nature, and it is uncertain if further exploration will result in upgrading of the Inferred Resources to Indicated or Measured Resources
- Resource tonnes are rounded to the nearest thousand
- Totals may not add due to rounding





**Table 14.19 Mineral Resources (Sulfide) as of December 31, 2015**

Category	Vein Type	Vein	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
Measured Resources	Silver Veins	Bateas	14,000	656	0.15	0.45	0.69
		Bateas Piso	1,000	1,104	0.22	0.20	0.35
		Total	15,000	676	0.15	0.44	0.67
	Polymetallic Veins	Animas*	656,000	79	0.33	1.42	2.98
		Animas NE*	275,000	105	0.36	2.60	2.74
		Santa Catalina	7,000	150	1.10	1.82	2.32
		Soledad	35,000	385	1.96	1.25	1.69
		Silvia	6,000	131	0.55	2.47	3.55
		Total	980,000	98	0.40	1.75	2.87
Total Measured Resources			995,000	107	0.40	1.73	2.83
Indicated Resources	Silver Veins	Bateas	60,000	564	0.14	0.21	0.37
		Bateas Piso	1,000	1,647	0.35	0.20	0.32
		Cimoide La Plata	27,000	606	3.19	0.01	0.01
		La Plata	22,000	1,160	1.54	0.02	0.01
		San Cristóbal*	143,000	225	0.17	0.35	0.57
		Total	254,000	434	0.60	0.25	0.41
	Polymetallic Veins	Animas*	1,054,000	65	0.27	1.77	3.24
		Animas NE*	1,211,000	87	0.20	3.43	4.41
		Silvia	19,000	151	1.26	1.67	2.29
		Soledad	47,000	268	2.00	1.56	1.76
		Santa Catalina	18,000	113	0.92	1.92	3.30
		Total	2,349,000	81	0.28	2.62	3.81
Total Indicated Resources			2,603,000	116	0.31	2.39	3.48
Total Measured + Indicated Resources			3,598,000	113	0.34	2.21	3.30
Inferred Resources	Silver Veins	Bateas	41,000	604	0.15	0.15	0.24
		Bateas Piso	7,000	914	0.23	0.12	0.29
		Bateas Techo	7,000	498	0.57	0.04	0.07
		La Plata	27,000	291	1.79	0.11	0.51
		Cimoide La Plata	38,000	403	2.06	0.01	0.03
		San Cristóbal*	76,000	280	0.12	0.12	0.19
		Paralela	40,000	480	0.41	0.20	0.60
		San Carlos	9,000	500	0.23	0.06	0.34
		San Pedro	61,000	748	2.77	0.00	0.00
		Ramal Piso Carolina	95,000	176	6.53	0.08	0.13
		Don Luis II	129,000	489	0.90	0.06	0.12
		Total	530,000	431	2.02	0.08	0.18
	Polymetallic Veins	Animas*	625,000	45	0.20	1.45	3.10
		Animas NE*	1,358,000	73	0.18	2.72	3.90
		Silvia	20,000	135	1.13	1.60	2.85
		Soledad	27,000	242	1.53	1.49	2.23
		Santa Catalina	5,000	125	0.55	1.57	2.29
		Patricia	10,000	233	1.01	0.72	0.90
		Pilar	17,000	215	2.02	0.57	0.46
Nancy*	471,000	91	0.77	3.43	5.32		
Total	2,533,000	73	0.33	2.49	3.90		
Total Inferred Resources			3,063,000	135	0.62	2.08	3.26
Please refer to applicable qualifying notes below Table 4.18							

### 14.11.1 Comparison to previous estimates

The Fortuna (2015) press release detailed the previously publicly released Mineral Resources and Mineral Reserves of Caylloma as of December 31, 2014. The same methodology was used to update the resources as of June 30, 2015 which were depleted to take into account production between July and the end of the year and reported as of December 31, 2015 (Fortuna, 2016). The Mineral Resource estimate as of December 31, 2014 are summarized in Table 14.20 and Table 14.21, being inclusive of Mineral Reserves. The 2014 Mineral Resources were reported using the same NSR cut-off values (US\$50/t for wide veins and US\$100/t for narrow veins).

**Table 14.20 Summary of Mineral Resources (Oxide) reported as of December 31, 2014**

Category	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
Measured	182,000	161	0.40	1.11	1.25
Indicated	337,000	214	0.41	0.81	1.18
Measured + Indicated	<b>519,000</b>	<b>195</b>	<b>0.40</b>	<b>0.92</b>	<b>1.20</b>
Inferred	<b>241,000</b>	<b>112</b>	<b>0.42</b>	<b>1.22</b>	<b>1.61</b>

**Table 14.21 Summary of Mineral Resources (Sulfide) reported as of December 31, 2014**

Category	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
Measured	1,158,000	104	0.38	1.64	2.75
Indicated	3,262,000	114	0.32	2.17	3.21
Measured + Indicated	<b>4,420,000</b>	<b>111</b>	<b>0.34</b>	<b>2.03</b>	<b>3.09</b>
Inferred	<b>4,115,000</b>	<b>134</b>	<b>0.60</b>	<b>2.02</b>	<b>3.26</b>

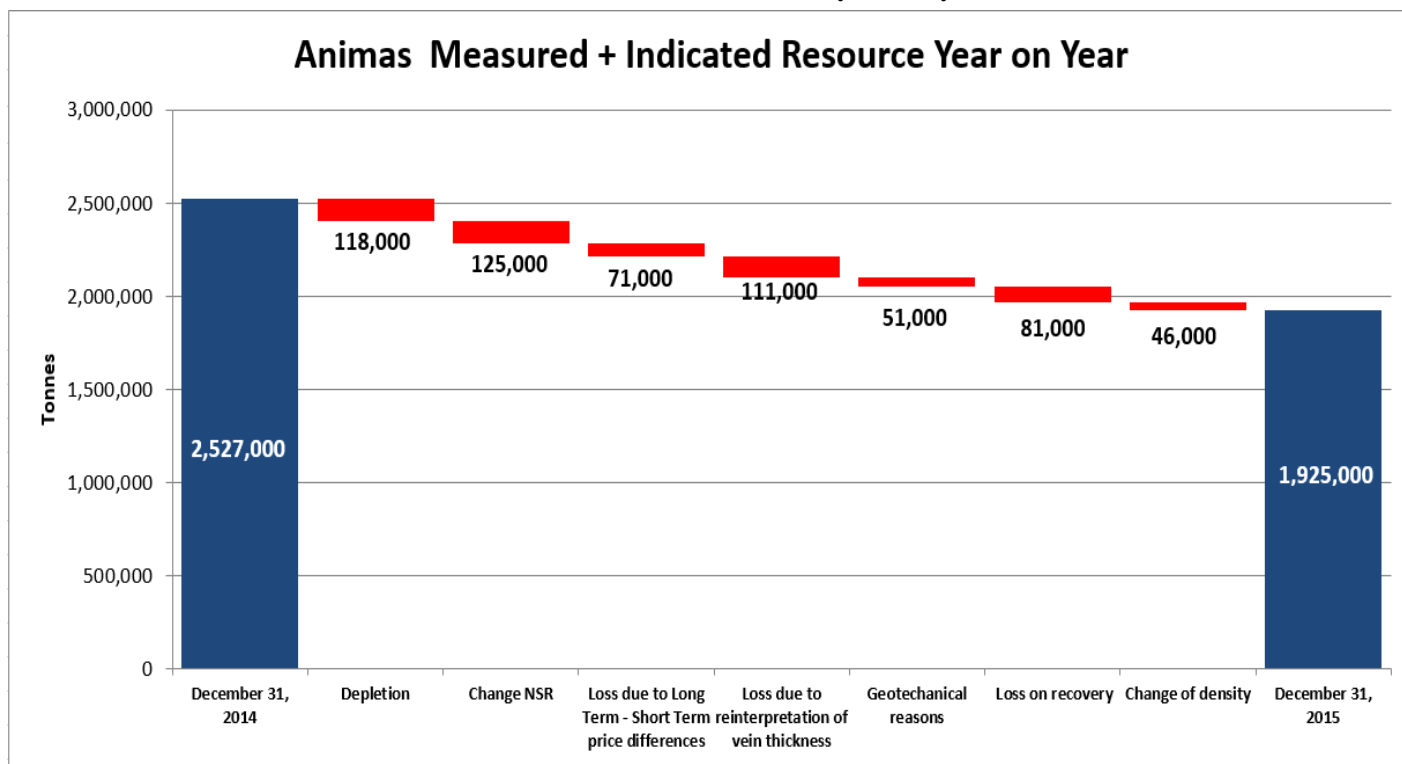
Measured and Indicated Resource decreased from 4.94 Mt to 4.11 Mt with silver grades decreasing slightly from 120 g/t Ag to 118 g/t Ag. Lead grades increased from 1.92 % Pb to 2.19 % Pb and zinc grades increased from 2.89 % Zn to 3.13 % Zn reflecting the infill drilling conducted in the base metal-rich portions of the Animas NE vein. Total Inferred Resource tonnes decreased from 4.36 Mt to 3.39 Mt with a one percent decrease in the average silver grade, an eleven percent increase in the lead grade, and a four percent increase in the zinc grade while the gold grades remained unchanged. The primary reasons for these changes are:

- Production-related depletion of 314,000 t of ore averaging 192 g/t Ag, 0.31 g/t Au, 3.34 % Pb, and 4.87 % Zn extracted from December 31, 2014 to December 31, 2015
- Depletion of 536,000 t of low grade material due to changes in the NSR values as a result of updated commercial terms and adjusted metal prices during vein modeling.
- Upgrading of resources through the infill drilling program resulted in Measured and Indicated Resources in the Animas NE vein increasing by 130,000 t at an average 113 g/t Ag, 0.29 g/t Au, 5.09 % Pb, and 5.01 % Zn. Measured and Indicated Resources in the Bateas and Bateas Piso Vein were also increased due to infill drilling by 8,000 t at an average 517 g/t Ag, 0.17 g/t Au, 0.13 % Pb, and 0.23 % Zn

- Development of exploration galleries to explore the Animas NE Vein increasing the Measured and Indicated Resources by 13,000 t at an average 96 g/t Ag, 0.20 g/t Au, 3.13 % Pb, and 7.84 % Zn
- Discovery of 30,000 t of Inferred Resources from the Bateas, Bateas Piso and Animas NE veins averaging 183 g/t Ag, 0.32 g/t Au, 2.72 % Pb, and 1.80 % Zn
- Sterilization of resources totaling 280,000 t or 1.1 Moz of silver due to differences in metal prices used for long term reporting and those used for extraction in 2015.
- A reduction of 752,000 t totaling 2.7 Moz of silver due primarily to changes in the geological interpretation (437,000 t), losses during recovery (129,000 t), geotechnical issues (99,000 t), and adjustments in density (87,000 t).

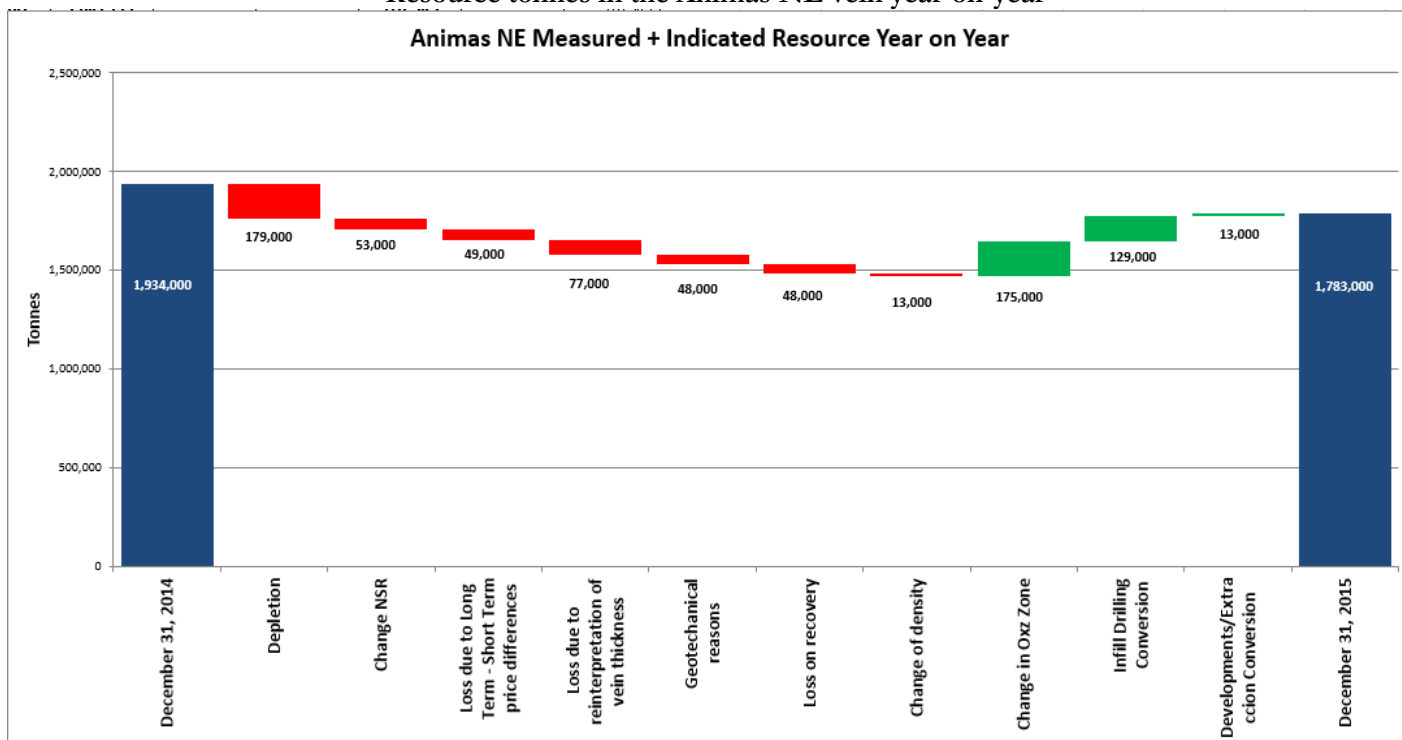
Taking into account all of the above, the contained silver ounces in the Measured and Indicated classification decreased from 19.1 Moz Ag to 15.6 Moz Ag while contained silver ounces in the Inferred classification decreased from 18.5 Moz to 14.3 Moz Ag. Tonnes year-on-year decreased from 3.3 Mt to 2.6 Mt in the Animas vein, from 4.2 Mt to 3.4 Mt in the Animas NE vein, and from 0.19 Mt to 0.12 Mt in the Bateas vein. The reasons for these changes to Measured + Indicated Resources are detailed in waterfall diagrams displayed in Figure 14.3, Figure 14.4, and Figure 14.5.

**Figure 14.3 Waterfall diagram showing changes to Measured + Indicated Resource tonnes in the Animas vein year-on-year**

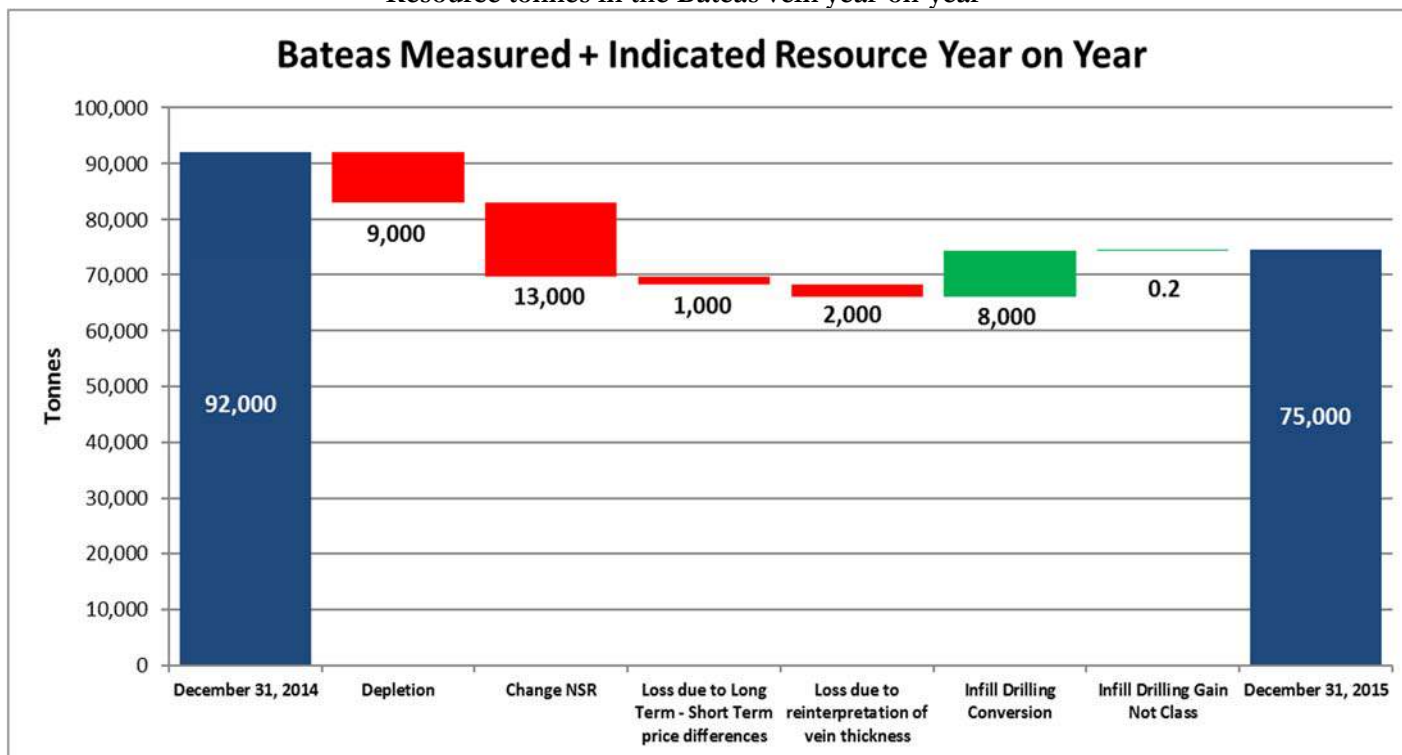




**Figure 14.4 Waterfall diagram showing changes to Measured + Indicated Resource tonnes in the Animas NE vein year-on-year**



**Figure 14.5 Waterfall diagram showing changes to Measured + Indicated Resource tonnes in the Bateas vein year-on-year**



In addition to reconciling the resources as of December 31, 2015 to the previously publicly released resources as of December 31, 2014 an additional evaluation was conducted to reconcile the changes as compared to the Mineral Resources reported in the previously filed Technical Report (Chapman & Kelly, 2013) estimated as of December 31, 2012. (Table 14.20 and Table 14.21) being inclusive of Mineral Reserves. The 2012 Mineral Resources were reported using NSR cut-off values of US\$30/t.

**Table 14.20 Summary of Mineral Resources (Oxide) reported as of December 31, 2012**

Category	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
Measured	194,800	136	0.38	1.45	1.66
Indicated	694,900	203	0.44	1.07	1.15
Measured + Indicated	<b>889,700</b>	<b>191</b>	<b>0.43</b>	<b>1.16</b>	<b>1.26</b>
Inferred	<b>440,000</b>	<b>159</b>	<b>0.36</b>	<b>0.78</b>	<b>0.93</b>

**Table 14.21 Summary of Mineral Resources (Sulfide) reported as of December 31, 2012**

Category	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
Measured	1,575,700	94	0.34	1.55	2.46
Indicated	3,287,800	122	0.40	1.55	2.37
Measured + Indicated	<b>4,863,500</b>	<b>113</b>	<b>0.38</b>	<b>1.55</b>	<b>2.40</b>
Inferred	<b>6,193,000</b>	<b>97</b>	<b>0.27</b>	<b>1.92</b>	<b>2.70</b>

Measured and Indicated Resource decreased from 4.75 Mt to 4.11 Mt with silver grades decreasing from 125 g/t Ag to 118 g/t Ag. Lead grades increased from 1.49 % Pb to 2.19 % Pb and zinc grades increased from 2.22 % Zn to 3.13 % Zn reflecting the exploration and infill drilling conducted in the base metal-rich portions of the Animas NE vein. Total Inferred Resource tonnes decreased significantly from 6.63 Mt to 3.39 Mt (a forty-nine percent decrease) with a thirty percent decrease in the average silver grade, a twenty percent increase in the lead grade, and a twenty-eight percent increase in the zinc grade. The primary reasons for these changes are detailed in the waterfall diagrams for Measured + Indicated Resources (Figure 14.6) and the Inferred Resources (Figure 14.7).



Figure 14.6 Waterfall diagram showing changes to Measured + Indicated Resource tonnes from prior filed Technical Report (Chapman & Kelly, 2013)

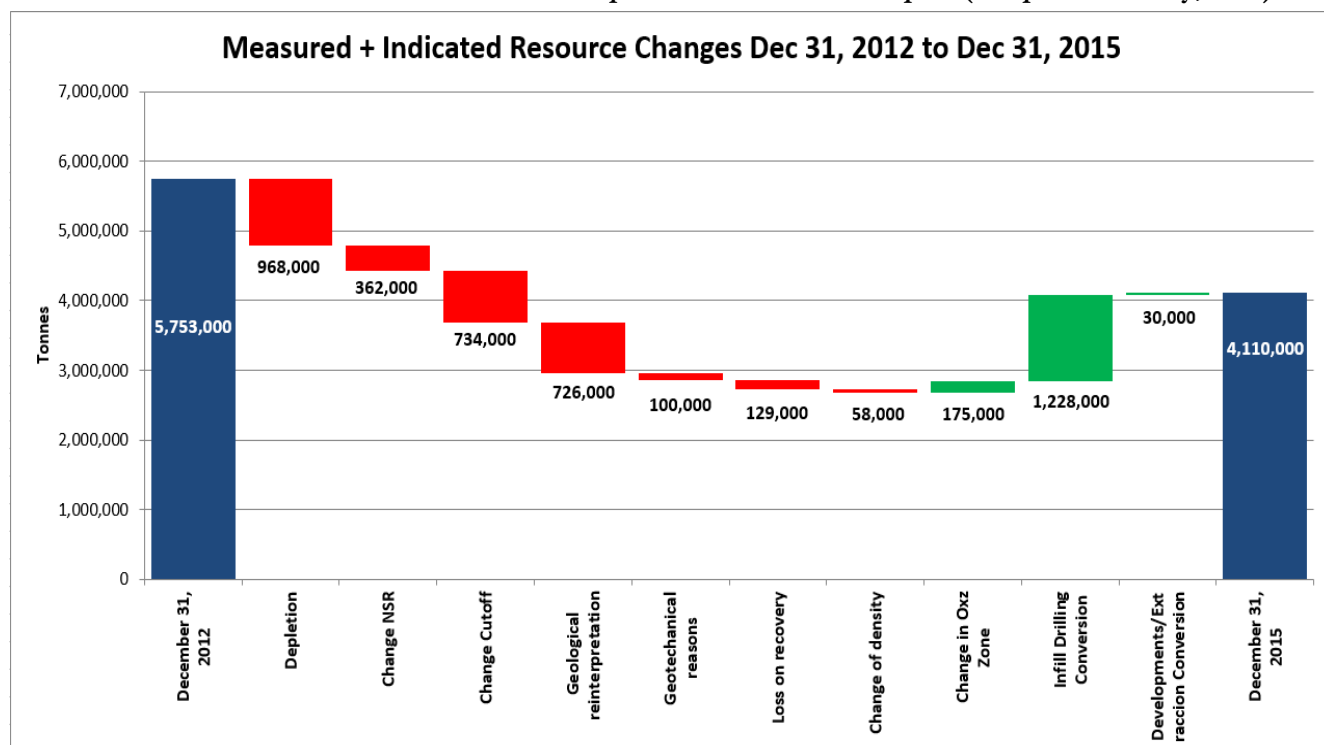
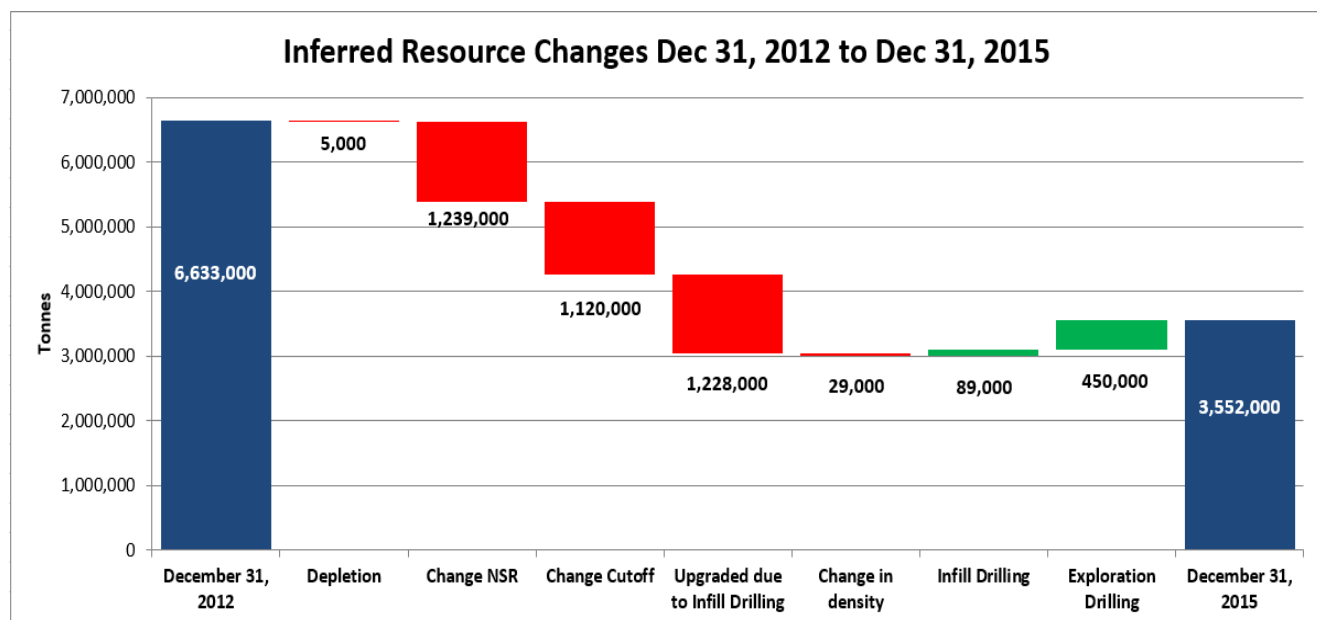


Figure 14.7 Waterfall diagram showing changes to Inferred Resource tonnes from prior filed Technical Report (Chapman & Kelly, 2013)



## 15 Mineral Reserve Estimates

The following chapter describes in detail the Mineral Reserve estimation methodology. Mineral Resources and Mineral Reserves are estimated as of June 30, 2015 and reported as of December 31, 2015 taking into account production-related depletion for the period of July 1, 2015 through December 31, 2015.

Mineral Resources have been reported in three categories: Measured, Indicated, and Inferred. The Mineral Reserve estimate has considered only Measured and Indicated Mineral Resources as only these categories have sufficient geological confidence to be considered Mineral Reserves (CIM, 2014). Measured Resources may become Proven Reserves and Indicated Resources may become Probable Reserves.

### 15.1 Mineral Reserve methodology

The Mineral Reserve estimation procedure for Minera Bateas is defined as follows:

- Review of Mineral Resources
- Identification of accessible Mineral Resources using current mining practices
- Removal of inaccessible Measured and Indicated Mineral Resources
- Removal of Inferred Resources
- Dilution of tonnages and grades for each vein based on a dilution factor calculated by the planning department
- After obtaining the resources with diluted tonnages and grades, the value per tonne of each block is determined based on metal prices and metallurgical recoveries for each metal
- A breakeven cut-off grade (total operating cost in US\$/t) is determined for each vein based on operational costs of mining, processing, administration, commercial, and general administrative costs. If the net smelter return (NSR) of a block is higher than the breakeven cut-off grade, the block is considered a part of the Mineral Reserve, otherwise the block is considered either a resource exclusive of reserve or waste
- Depletion of Mineral Reserves and Mineral Resources exclusive of reserves relating to operational extraction between July 1 and December 31, 2015
- Mineral Reserve and Mineral Resources exclusive of reserves tabulation and reporting as of December 31, 2015

Each vein has a different operating cost; therefore, Mineral Reserve evaluation was performed for each individual vein.

### 15.2 Mineral Resource handover

The Mineral Resource reported by Mineral Resource Management (Tables 14.18 and 14.19) are comprised of Measured, Indicated and Inferred categories.

Upon receipt of the block model a review was conducted to confirm the Mineral Resource was reported correctly and to validate the various fields in the model.

For estimating Mineral Reserves, only accessible Measured and Indicated Resources have been considered. Table 15.1 shows the total of Measured and Indicated Resources that were considered for conversion into Mineral Reserves.

**Table 15.1 Measured and Indicated Resources considered for Mineral Reserves**

Category	Vein	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
<b>Measured Resources</b>	Animas (Sulfide)	656,000	79	0.33	1.42	2.98
	Animas (Oxide)	83,000	183	0.37	0.99	1.59
	Animas NE (Sulfide)	275,000	105	0.36	2.60	2.74
	Animas NE (Oxide)	114,000	138	0.50	2.27	1.92
	Santa Catalina	7,000	150	1.10	1.82	2.32
	Soledad	35,000	385	1.96	1.25	1.69
	Silvia	6,000	131	0.55	2.47	3.55
	Bateas	14,000	656	0.15	0.45	0.69
	Bates Piso	1,000	1,104	0.22	0.20	0.35
	<b>Total</b>	<b>1,192,000</b>	<b>115</b>	<b>0.41</b>	<b>1.73</b>	<b>2.66</b>
<b>Indicated Resources</b>	Animas (Sulfide)	1,054,000	65	0.27	1.77	3.24
	Animas (Oxide)	132,000	186	0.40	1.01	1.77
	Animas NE (Sulfide)	1,211,000	87	0.20	3.43	4.41
	Animas NE (Oxide)	184,000	130	0.50	3.17	2.31
	Santa Catalina	19,000	151	1.26	1.67	2.29
	Soledad	47,000	268	2.00	1.56	1.76
	Silvia	18,000	113	0.92	1.92	3.30
	Bateas	60,000	564	0.14	0.21	0.37
	Bateas Piso	1,000	1,647	0.35	0.20	0.32
	Bateas Techo	100	313	0.27	0.05	0.05
	Cimoide La Plata	27,000	606	3.19	0.01	0.01
	La Plata	22,000	1,160	1.54	0.02	0.01
	San Cristóbal	143,000	225	0.70	0.35	0.57
	<b>Total</b>	<b>2,918,000</b>	<b>120</b>	<b>0.33</b>	<b>2.38</b>	<b>3.33</b>
<b>Measured +Indicated Resources</b>	<b>TOTAL</b>	<b>4,110,000</b>	<b>118</b>	<b>0.35</b>	<b>2.19</b>	<b>3.13</b>

This is the total of Mineral Resources to which dilution factors were applied for the estimation of Mineral Reserves.

## 15.3 Key Mining Parameters

### 15.3.1 Mining Recovery

Mining recovery levels vary due to the geometry of the vein and geotechnical characteristics of the material being mined. Some mineralized material cannot be economically extracted due to its isolated location; thickness being below the minimum mineable width; or due too other technical or economic constraints.

Overall mining recovery is 86 percent. Measured and Indicated Resources were reduced by 244,947 t due to bridges and 317,832 t due to non-accessible mineral for the reserve estimate. Mineral losses were estimated based on mine designs and specific analysis of isolated areas where mineral extraction is not viable due to technical difficulties or excessive operating cost demands.



### 15.3.2 Dilution

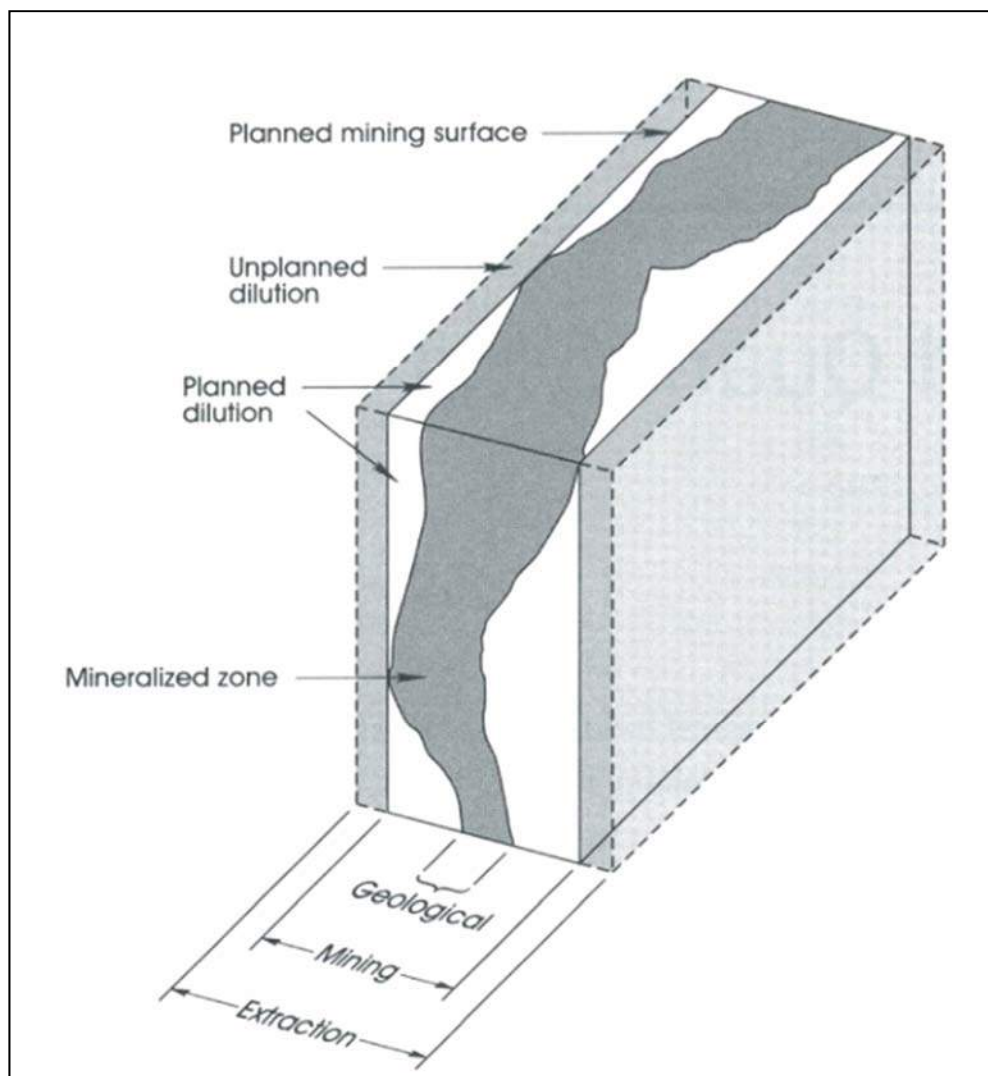
The dilution factor considers operational (over-break) and mucking effects. Dilution factors for the wider veins and the alternative narrow veins have been assessed independently. The assumption was made that non-mineralized material is waste that carries no grade; therefore, waste material was set at a zero value for metal contents.

The Caylloma Mine considers two types of dilution; operational and mucking.

#### Operational Dilution

The estimate of the operational dilution (*OP*) was based on the proportion of extracted mineral versus in-situ mineral obtained by reconciliation data for the previous twelve months. It includes both the planned and unplanned components displayed in Figure 15.1.

**Figure 15.1 Conceptual diagram of operational dilution (William et al, 2001)**



Planned dilution is caused by the inclusion of waste inside the planned mining section based on the minimum mining width allowed by the mechanized equipment. Within this mining width, it is not possible to differentiate waste material from ore. The planned dilution is also referred to as internal dilution. The unplanned or external dilution is caused by the waste material located outside the defined mineralized vein. This material is also difficult to avoid because of mining geometry, over break impacts from blasting activities or geotechnical conditions.

The unplanned dilution was calculated based on underground surveys defining the mined volumes between July 2014 and June 2015, or total material encountered (ore and waste) at a zero cut-off grade. The following formula was applied to calculate the total dilution, sourced from William et al (2001) dilution definitions, equation number 2.

$$\text{Dilution} = \text{Tonnes waste mined} / (\text{Tonnes ore mined} + \text{Tonnes waste mined})$$

Based on the above a dilution factor was estimated for each vein in accordance with the vein width (see Table 15.2).

#### Mucking Dilution

The mucking dilution (*MD*) estimates the undesired waste material extracted as part of the mucking process and is based on the operational experience over the last twelve months at the mine.

$$MD = 4 \%$$

Based on the above, the total dilution (*TD*) applied for the reserves estimate is defined by the following formula:

$$TD = OP + MD$$

Where:

*OP* = Operational dilution

*MD* = Mucking dilution

Based on the above methodology, the average dilution factors applied to the wide and narrow veins included in the Measured and Indicated Resources are displayed in Table 15.2.

**Table 15.2 Average dilution factors for wide and narrow veins**

<b>Vein Type</b>	<b>Average Dilution Factor (%)</b>
Wide vein > 1.5 m	20
Narrow vein < 1.5 m	40

## 15.4 Metal prices, metallurgical recovery and NSR values

Metal prices used for Mineral Reserve estimation (Table 15.3) were determined by the corporate financial department of Fortuna in May 2015.

**Table 15.3 Metal prices**

<b>Metal</b>	<b>Price</b>
Silver (US\$/oz)	19
Gold (US\$/oz)	1,140
Lead (US\$/t)	2,150
Zinc (US\$/t)	2,300

Metallurgical recoveries used for Mineral Reserve estimation are displayed in Table 15.4 and were based on achieved recoveries observed in the processing plant by Minera Bateas during the period of July 2014 to June 2015.

**Table 15.4 Metallurgical recoveries**

<b>Metal</b>	<b>Metallurgical Recovery (%)</b>
Silver	84.5
Gold	39.5
Lead	92.6
Zinc	89.9

NSR values depend on various parameters including metal prices, metallurgical recovery, price deductions, refining charges and penalties. Methodology for NSR determination is the same as that described in Section 14.11. NSR values used for Mineral Reserve estimation are detailed in Table 15.5.

**Table 15.5 NSR values**

<b>Metal</b>	<b>NSR Value</b>
Silver (US\$/g)	0.45
Gold (US\$/g)	13.53
Lead (US\$/%)	14.85
Zinc (US\$/%)	12.68

## 15.5 Operating costs

Breakeven cut-off values were determined for each vein based on actual operating costs incurred in the period July 2014 to June 2015. These include exploitation and treatment costs, general expenses and administrative, and commercialization costs (including concentrate transportation). As operations are not centralized, each vein has a different operating cost, mainly due to the mining method employed, transportation (mine to plant), support, and power consumption. Breakeven cut-off values used for Mineral Reserve estimation are detailed in Table 15.6.

**Table 15.6 Breakeven cut-off values applied to each vein**

<b>Mining Method</b>	<b>Vein</b>	<b>Breakeven cut-off value(US\$/t)</b>
Mechanized	Animas	82.40
	Animas NE	82.40
Conventional	Bateas, Bateas Piso, Bateas Techo	173.74
	Soledad	173.74
	La Plata, Cimoide La Plata	173.74
	Silvia	173.74
	Santa Catalina	173.74
Semi-mechanized	Animas	95.63
	Animas NE	97.63
	San Cristóbal	97.07

## 15.6 Mineral Reserves

Blocks whose NSR values are higher than the operating cost (breakeven cut-off value) have been reported within the Mineral Reserve inventory. Table 15.7 shows Mineral

Reserves estimated as of December 31, 2015. Measured Resources have been converted to Proven Reserves and Indicated Resources have been converted to Probable Reserves. There are no modifying factors that would result in Measured Resources being classified as Probable Reserves. Mineral Resources exclusive of Mineral Reserves as of December 31, 2015 are reported in Table 15.8.

**Table 15.7 Mineral Reserves as of December 31, 2015**

Category	Vein	Tonnes	NSR (US\$/t)	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Average width (m)	Contained Metal	
									Ag (koz)	Au (koz)
Proven	Animas (Sulfide)	87,000	122	84	0.30	2.17	3.82	3.21	234	0.8
	Animas (Oxide)	39,000	114	171	0.35	0.92	1.46	5.27	215	0.4
	Animas NE (Sulfide)	71,000	114	114	0.46	2.52	1.53	5.98	260	1.1
	Animas NE (Oxide)	47,000	131	148	0.47	2.35	1.83	5.72	223	0.7
	Soledad	7,000	278	457	3.24	0.83	1.32	0.77	109	0.8
	Bateas	3,000	411	874	0.23	0.43	0.72	0.58	85	0.0
	<b>Total</b>	<b>254,000</b>	<b>129</b>	<b>138</b>	<b>0.47</b>	<b>2.05</b>	<b>2.34</b>	<b>4.66</b>	<b>1,132</b>	<b>3.8</b>
Probable	Animas (Sulfide)	474,000	112	64	0.23	2.26	3.69	4.03	969	3.5
	Animas (Oxide)	56,000	130	175	0.39	1.31	2.14	3.46	316	0.7
	Animas NE (Sulfide)	953,000	149	81	0.16	3.63	4.44	6.46	2,483	4.8
	Animas NE (Oxide)	128,000	150	138	0.47	3.49	2.35	4.63	568	1.9
	Soledad	8,000	255	374	4.69	0.67	1.03	0.63	96	1.2
	Bateas	29,000	303	656	0.16	0.16	0.30	0.39	610	0.1
	Bateas Piso	1,000	811	1,780	0.40	0.17	0.25	0.29	52	0.0
	Cimoide La Plata	19,000	325	613	3.65	0.01	0.02	1.33	366	2.2
	La Plata	12,000	764	1,647	1.78	0.01	0.00	1.62	657	0.7
	San Cristóbal	45,000	162	328	0.17	0.35	0.54	1.67	472	0.2
	<b>Total</b>	<b>1,724,000</b>	<b>148</b>	<b>119</b>	<b>0.28</b>	<b>2.95</b>	<b>3.73</b>	<b>5.21</b>	<b>6,590</b>	<b>15.4</b>
<b>Total Proven + Probable Reserves</b>		<b>1,979,000</b>	<b>146</b>	<b>121</b>	<b>0.30</b>	<b>2.83</b>	<b>3.55</b>	<b>5.14</b>	<b>7,716</b>	<b>19.3</b>

Notes

- Mineral Reserves and Mineral Resources are as defined by CIM Definition Standards on Mineral Resources and Mineral Reserves
- Mineral Reserves are estimated as of June 30, 2015 and reported as of December 31, 2015 taking into account production-related depletion for the period of July 1, 2015 through December 31, 2015
- Reserves are reported above a NSR breakeven cut-off value of US\$82.73/t for Animas, US\$82.53/t for Animas NE, US\$97.07/t San Cristóbal; US\$173.74/t for Bateas, Cimoide La Plata, La Plata, and Soledad
- Metal prices used in the NSR evaluation are US\$19.00/oz for silver, US\$1,140.00/oz for gold, US\$2,150/t for lead and US\$2,300/t for zinc
- Metallurgical recovery rates used in the NSR evaluation are 84.5 % for silver, 39.5 % for gold, 92.6 % for lead, and 89.9 % for zinc
- Operating costs were estimated based on actual operating costs incurred from July 2014 through June 2015
- Reserve tonnes are rounded to the nearest thousand, totals may not add due to rounding



**Table 15.8 Mineral Resources exclusive of Mineral Reserves as of December 31, 2015**

Category	Vein	Tonnes	NSR (US\$/t)	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Contained Metal	
								Ag (koz)	Au (koz)
Measured	Animas (Sulfide)	388,000	78	64	0.30	0.98	2.37	803	3.7
	Animas NE (Sulfide)	83,000	89	82	0.33	1.60	1.90	218	0.9
	Animas (Oxide)	28,000	80	91	0.26	0.90	1.73	81	0.2
	Animas NE (Oxide)	42,000	83	92	0.45	1.25	1.35	124	0.6
	Santa Catalina	7,000	137	147	1.07	1.83	2.33	34	0.2
	Soledad	20,000	166	238	1.34	1.34	1.64	157	0.9
	Silvia	6,000	148	131	0.55	2.47	3.55	26	0.1
	Bateas	7,000	172	352	0.07	0.37	0.54	83	0.0
	<b>Total</b>	<b>582,000</b>	<b>85</b>	<b>82</b>	<b>0.36</b>	<b>1.11</b>	<b>2.16</b>	<b>1,526</b>	<b>6.7</b>
Indicated	Animas (Sulfide)	591,000	75	54	0.25	1.14	2.43	1,028	4.8
	Animas NE (Sulfide)	338,000	82	61	0.21	1.41	2.40	661	2.3
	Animas (Oxide)	56,000	79	99	0.31	0.69	1.56	177	0.6
	Animas NE (Oxide)	64,000	81	73	0.41	1.54	1.59	149	0.8
	Santa Catalina	19,000	138	150	1.25	1.67	2.29	93	0.8
	Soledad	37,000	161	211	1.34	1.69	1.79	253	1.6
	Silvia	18,000	133	113	0.92	1.92	3.30	65	0.5
	Bateas	34,000	158	334	0.10	0.18	0.31	363	0.1
	Cimoide La Plata	12,000	174	349	1.29	0.00	0.01	138	0.5
	La Plata	12,000	160	336	0.66	0.03	0.01	132	0.3
	San Cristóbal	88,000	76	137	0.15	0.34	0.57	387	0.4
	<b>Total</b>	<b>1,269,000</b>	<b>86</b>	<b>84</b>	<b>0.31</b>	<b>1.14</b>	<b>2.10</b>	<b>3,445</b>	<b>12.7</b>
<b>Total Measured + Indicated Resources</b>		<b>1,851,000</b>	<b>86</b>	<b>84</b>	<b>0.32</b>	<b>1.13</b>	<b>2.12</b>	<b>4,972</b>	<b>19.3</b>
Inferred	Animas (Sulfide)	625,000	84	45	0.20	1.45	3.10	905	4.0
	Animas NE (Sulfide)	1,358,000	125	73	0.18	2.72	3.90	3,195	7.8
	Animas (Oxide)	46,000	89	83	0.40	1.06	2.40	123	0.6
	Animas NE (Oxide)	283,000	154	99	0.30	3.77	3.89	903	2.8
	Santa Catalina	5,000	116	125	0.55	1.57	2.29	20	0.1
	Soledad	27,000	180	242	1.53	1.49	2.23	211	1.3
	Silvia	20,000	136	135	1.13	1.60	2.85	86	0.7
	Bateas	41,000	279	604	0.15	0.15	0.24	802	0.2
	Bateas Piso	7,000	420	914	0.23	0.12	0.29	210	0.1
	Bateas Techo	7,000	234	498	0.57	0.04	0.07	105	0.1
	Cimoide La Plata	38,000	210	403	2.06	0.01	0.03	494	2.5
	La Plata	27,000	163	291	1.79	0.11	0.51	252	1.6
	Pilar	17,000	138	215	2.02	0.57	0.46	119	1.1
	Patricia	10,000	141	233	1.01	0.72	0.90	73	0.3
	San Cristóbal	76,000	132	280	0.12	0.12	0.19	689	0.3
	Paralela	40,000	232	480	0.41	0.20	0.60	622	0.5
	San Carlos	9,000	233	500	0.23	0.06	0.34	144	0.1
	San Pedro	61,000	374	748	2.77	0.00	0.00	1,462	5.4
	Nancy	471,000	170	91	0.77	3.43	5.32	1,371	11.6
	Ramal Piso Carolina	95,000	171	176	6.53	0.08	0.13	538	19.9
	Don Luis II	129,000	234	489	0.90	0.06	0.12	2,021	3.7
<b>Total Inferred Resources</b>		<b>3,392,000</b>	<b>142</b>	<b>132</b>	<b>0.59</b>	<b>2.20</b>	<b>3.30</b>	<b>14,348</b>	<b>64.7</b>

Notes on following page:

- Mineral Resources are as defined by CIM Definition Standards on Mineral Resources and Mineral Reserves 2010
- Mineral Resources and Mineral Reserves are estimated as of June 30, 2015 and reported as of December 31, 2015 taking into account production-related depletion for the period of July 1, 2015 through December 31, 2015
- Mineral Resources are exclusive of Mineral Reserves
- Mineral Resources which are not Mineral Reserves do not have demonstrated economic viability
- The estimate of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant issues
- Resources are reported based on an NSR cut-off grade of US\$50/t for wide veins and US\$100/t for narrow veins
- Metal prices used in the NSR evaluation are US\$19/oz for silver, US\$1,140/oz for gold, US\$2,150/t for lead and US\$2,300/t for zinc
- Metallurgical recovery values used in the NSR evaluation are 84.5 % for silver, 39.5 % for gold, 92.6 % for lead, and 89.9 % for zinc with the exception of the Ramal Piso Carolina vein that uses metallurgical recovery rates of 84% for Ag and 75% for Au
- Resource tonnes are rounded to the nearest thousand
- Totals may not add due to rounding

Grade tonnage curves have been calculated to display the effect of varying the NSR cut-off value on the recoverable reserve tonnes (Figure 15.2) as well as the effect of varying the silver grade on the tonnes (Figure 15.3). A long section showing the Mineral reserves and stope design is displayed in Figure 15.4.

**Figure 15.2 Mineral Reserve grade-tonnage curve - tonnes versus NSR value**

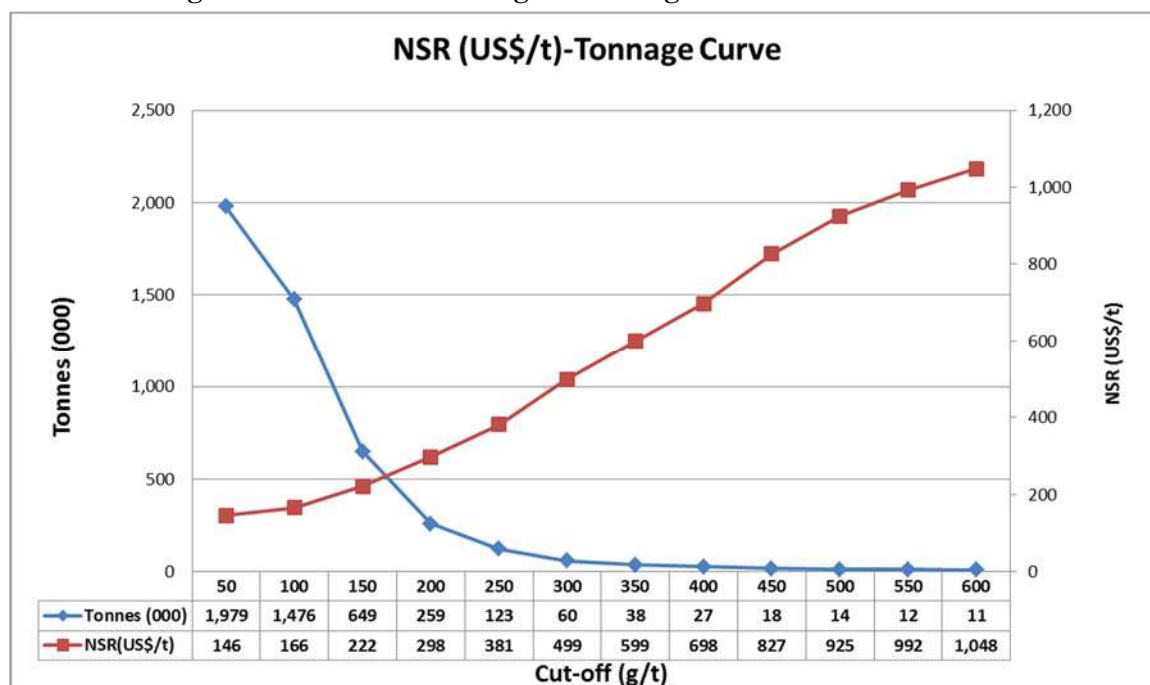




Figure 15.3 Mineral Reserve grade-tonnage curve - tonnes versus silver grade

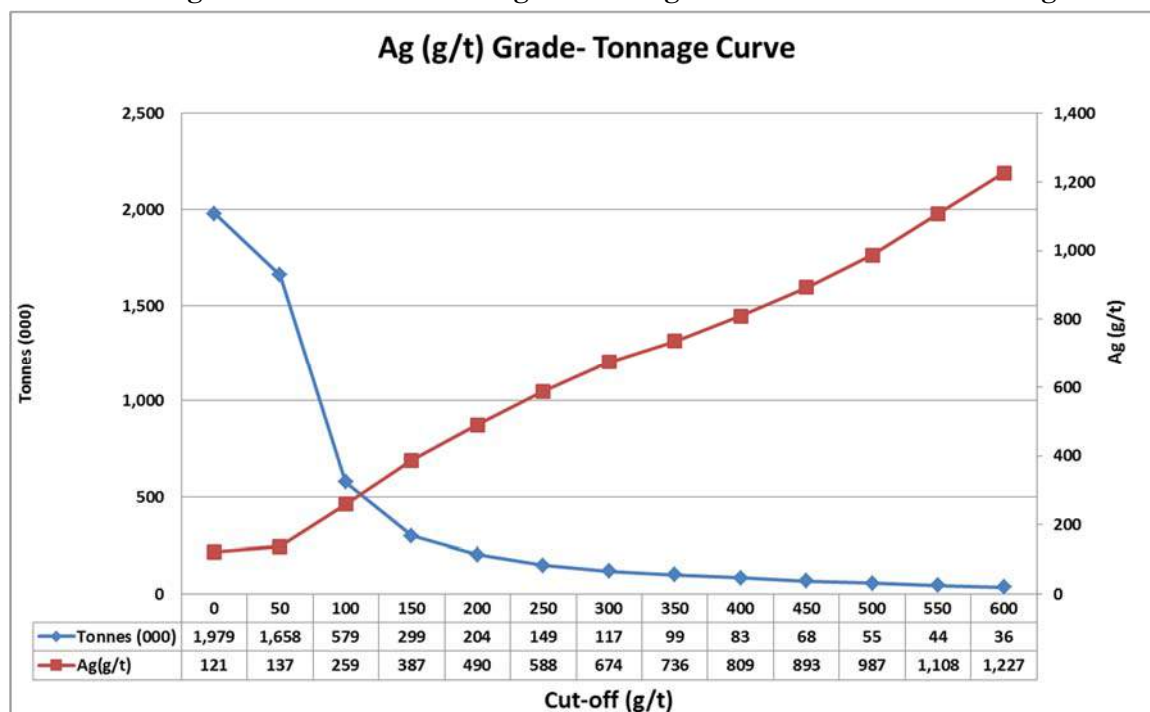
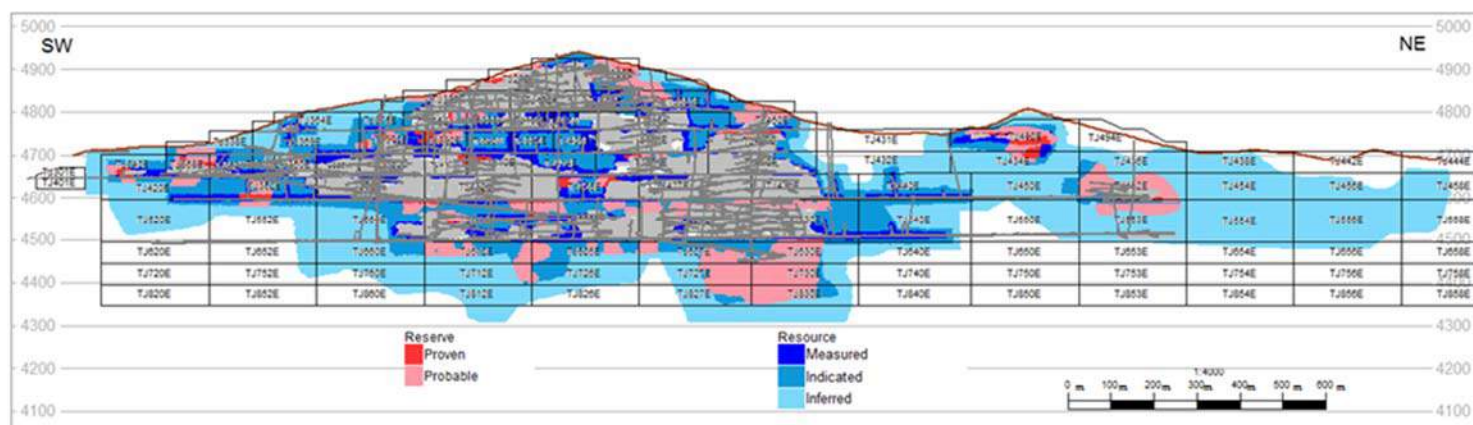


Figure 15.4 Longitudinal section showing Proven and Probable Reserves, Mineral Resources exclusive of reserves and stope design for the Animas vein



### 15.6.1 Comparison to previous reserve estimates

Figure 15.5 and Figure 15.6 display waterfall diagrams to demonstrate the differences in tonnes and silver ounces between the reserve estimate as of December 31, 2014 (Fortuna, 2015) and the updated estimate as of December 31, 2015 (Fortuna, 2016). As can be seen reserve tonnes decreased significantly from 3.03 Mt to 1.98 Mt and silver ounces from 13 Moz, primarily due to changes in the resource model (0.4 Mt loss due to adjustments in the geological interpretation and 0.2 Mt through lowering of NSR values), losses through depletion (0.4 Mt), and sterilization of remnant material that did not fulfill the short term economic criteria for mining (0.13 Mt). Some gains were seen (0.28 Mt) due to infill drilling upgrading Inferred Resources.



Figure 15.5 Waterfall diagram showing changes to Proven and Probable Reserve tonnes – year-on-year

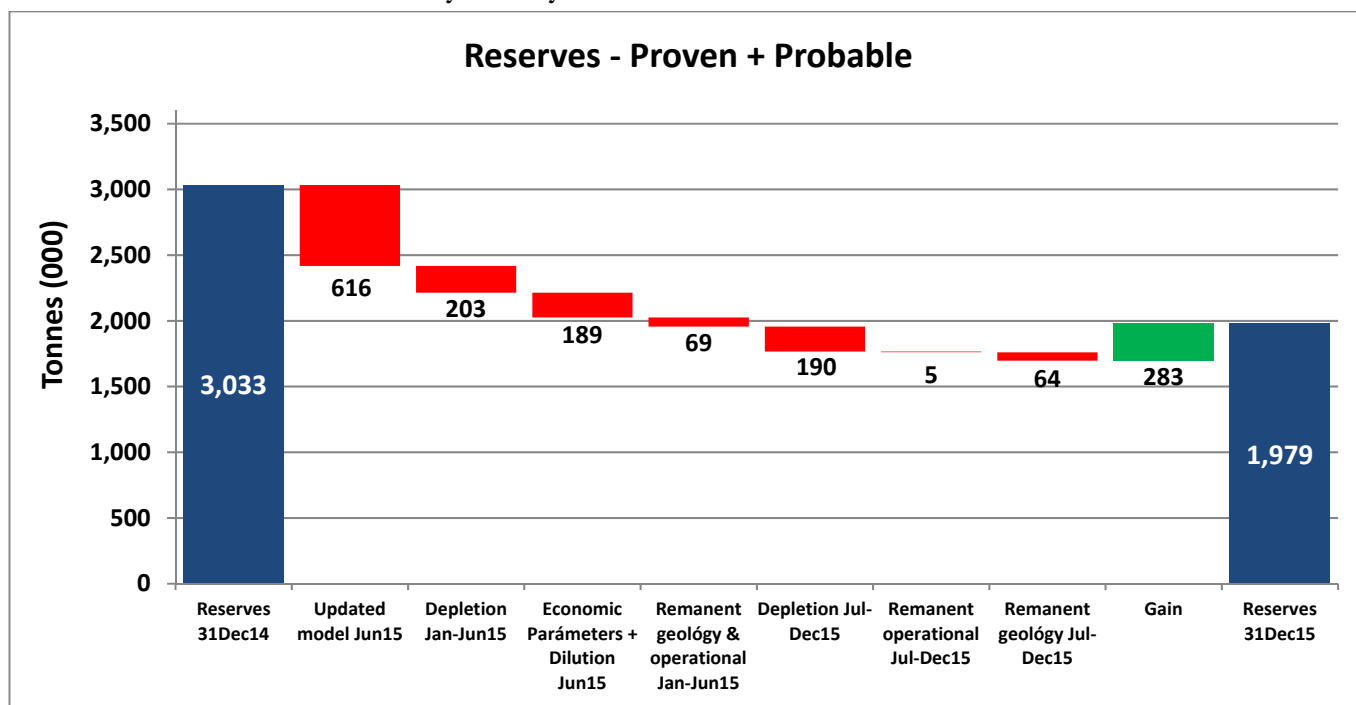
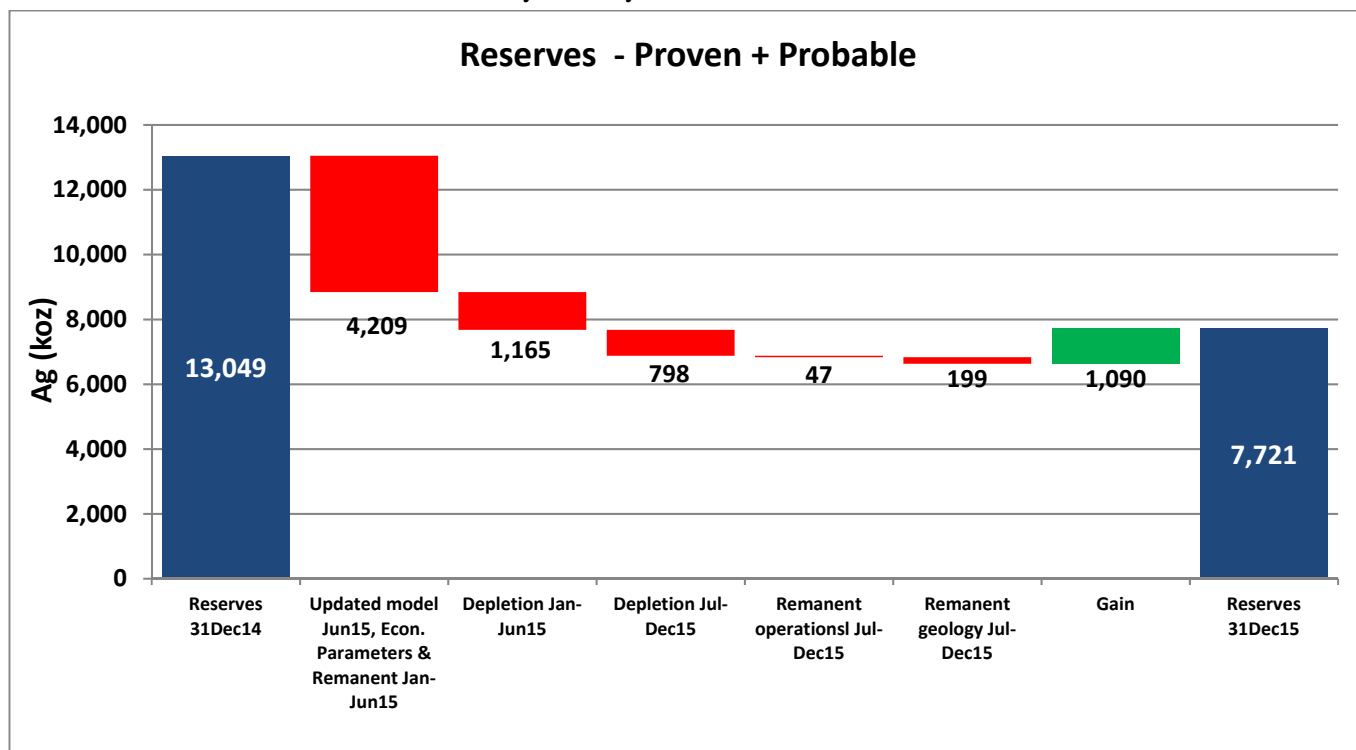


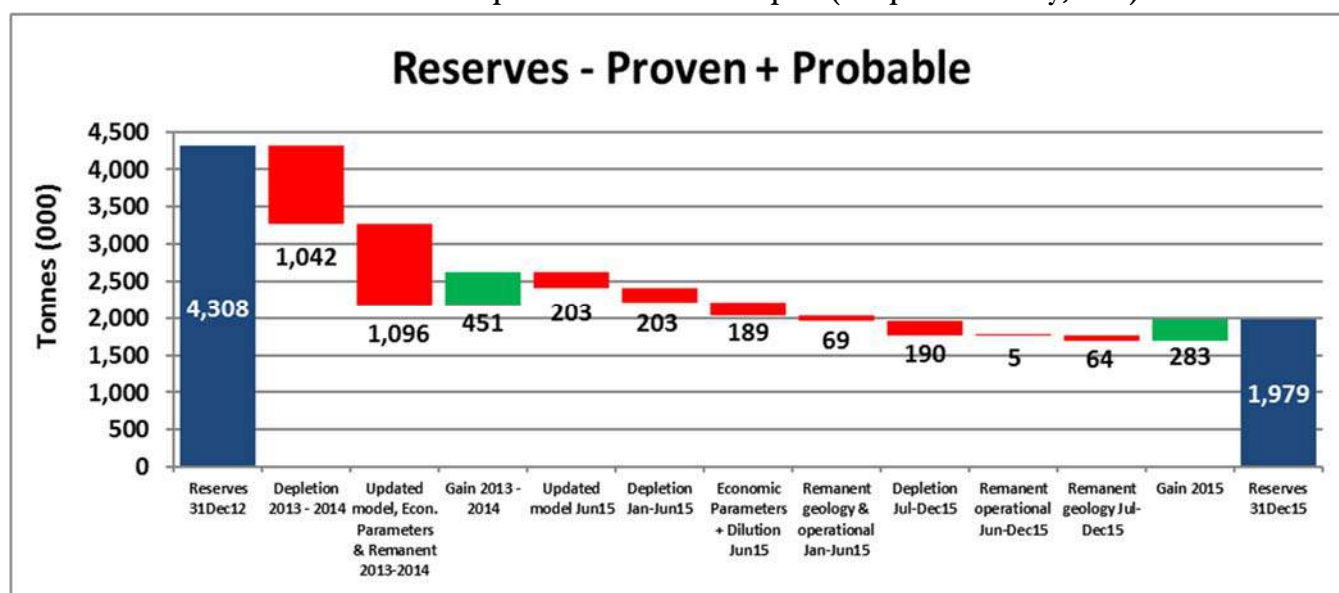
Figure 15.6 Waterfall diagram showing changes to Proven and Probable Reserve silver ounces – year-on-year



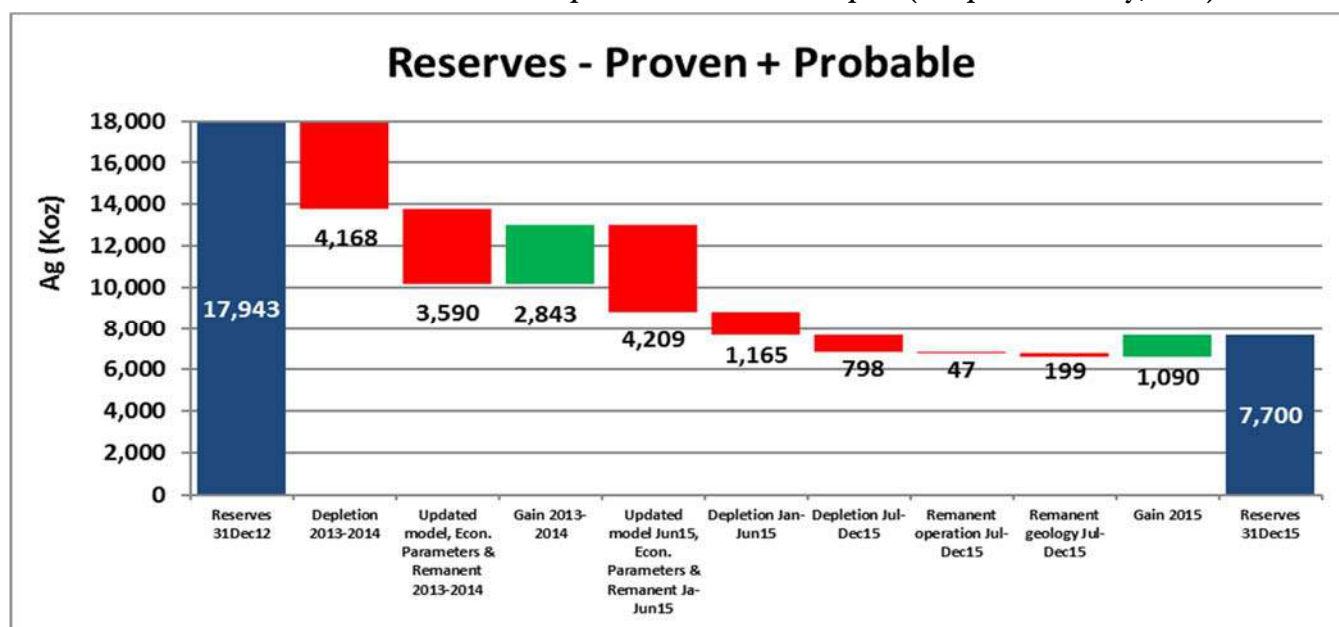


Reasons for the changes in the reported Probable and Proven Reserves since the previously filed Technical Report as of December 31, 2012 (Fortuna, 2013) are detailed in Figure 15.7 (tonnes) and Figure 15.8 (silver ounces). The biggest losses were due to changes in the cut-off in relation to lower metal prices and geological re-interpretation of the veins. Gains were made primarily through infill and exploration drilling.

**Figure 15.7 Waterfall diagram showing changes to Proven and Probable Reserve tonnes since previous Technical Report (Chapman & Kelly, 2013)**



**Figure 15.8 Waterfall Diagram showing changes to Proven and Probable Reserve silver ounces since previous Technical Report (Chapman & Kelly, 2013)**



## 16 Mining Methods

The mining method applied in the exploitation of the two main veins (Animas and Bateas) is overhand cut-and-fill using either mechanized, semi-mechanized or conventional extraction methods. All mining is undertaken in a southwest to northeast direction following the strike of the veins. Production capacity at the mine is 1,430 tonnes per day (tpd) since the upgrade to the plant in March 2016 but has the potential of achieving 1,500 tpd.

### 16.1 Hydrogeology

A hydrogeological study was conducted by Dianoia Consulting in October, 2015 for Minera Bateas to characterize mine hydrogeology and quantify groundwater ingress into the underground workings. The model provides a tool for developing the conceptual understanding of the groundwater system and to quantify a range of possible dewatering rates to consider for mine design.

Based on the transient hydrogeological modelling, the estimated groundwater inflows to the proposed underground mine reach a nominal 100 liters per second (l/s) for the worst case and a nominal 40 l/s for the base case scenarios.

Rainfall analysis and runoff assessment data was collected for the region and hydrological models were developed that predict average annual flows are minor and not expected to significantly impact the Caylloma Mine. Surface water flows were modelled for development of surficial water management facilities.

### 16.2 Geotechnical evaluations

The Geotechnical department of Minera Bateas continuously undertakes geotechnical evaluation through the classification of rock mass using RQD, RMR and Q systems. Results of the geotechnical evaluations for the different veins indicate the quality of the rock mass ranges from regular to good which is consistent with the behavior observed underground and allows openings with dimensions of up to 20 m wide, 6 m high, and 50 m long in the Animas vein.

The average indices of rock mass for the mine (Animas, Bateas and Soledad veins) are: RQD 60%, RMR 42 to 75 and Q 0.8 to 31. Based on these values the mining method of overhand cut-and-fill (with hydraulic and waste fill) is regarded as the most suitable. It is possible that a bulk mining method, such as sub-level stoping, could be applied in the Animas vein (responsible for 90 percent of tonnes produced), however the dip of the vein (43° average) would make sub-level stoping difficult.

### 16.3 Mining methods

The mining method applied by Minera Bateas is cut-and-fill which is used in mining steeply dipping orebodies in stable rock masses. Cut-and-fill is a bottom up mining method that consists of removing ore in horizontal slices, starting from a bottom undercut and advancing upwards. The following describes the cut-and-fill mechanized, semi-mechanized, and conventional extraction methods.

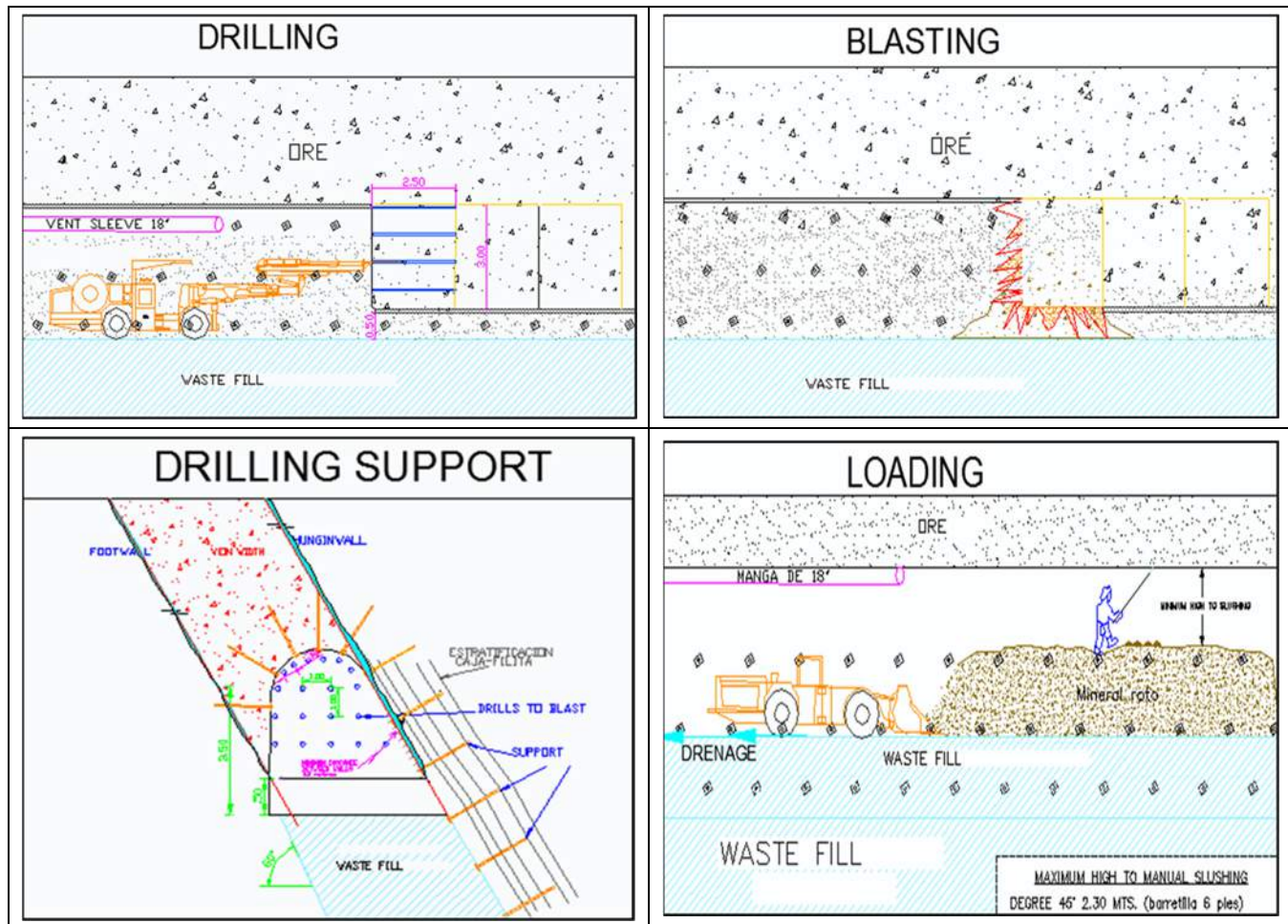


### 16.3.1 Mechanized cut-and-fill

Mechanized mining utilizes a jumbo drill rig and scoop tram for loading. The ore haulage is performed by a combination of locomotives and trucks. Rock support is applied through rock bolts and shotcrete. The average mining width ranges between 3.5 m and 17 m. Mechanized mining is regarded as only being suitable for the Animas vein based on the geological structure and geotechnical studies (Section 16.4). Approximately 90 percent of production comes from the Animas vein.

The mechanized mining sequence is shown in Figure 16.1 and includes: drilling (with a jumbo drill rig), blasting, support, loading (with a scoop tram) and haulage.

**Figure 16.1 Mechanized mining sequence**



### 16.3.2 Semi-mechanized cut-and-fill

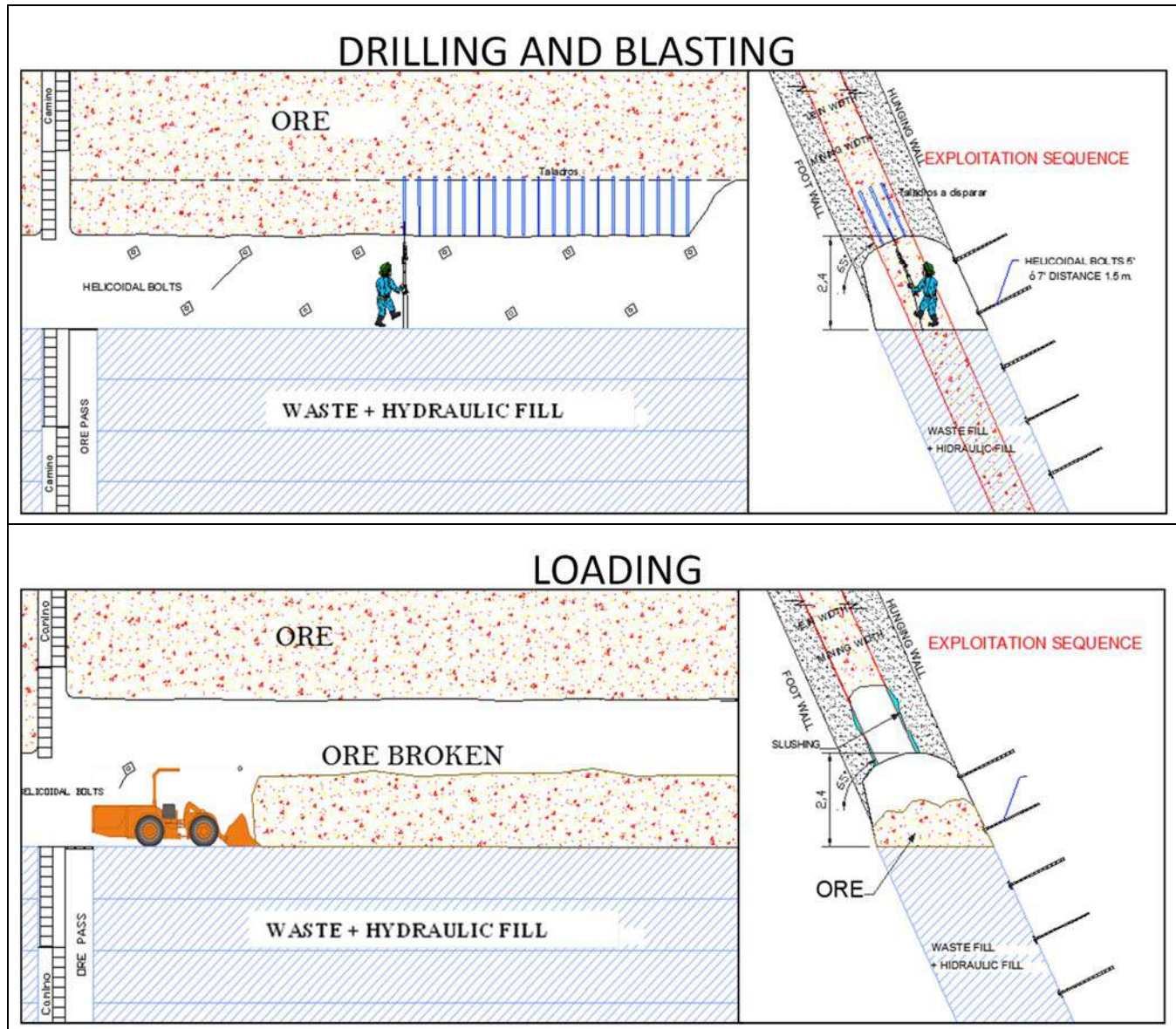
Semi-mechanized mining is performed using handheld drilling equipment (jacklegs) and scoops for loading. Ore haulage is performed by a combination of locomotives and dump trucks. Rock support is supplied using rock bolts installed using manual drilling and installation techniques. Semi-mechanized mining is applied to narrow veins with average widths between 0.8 m and 2.0 m.





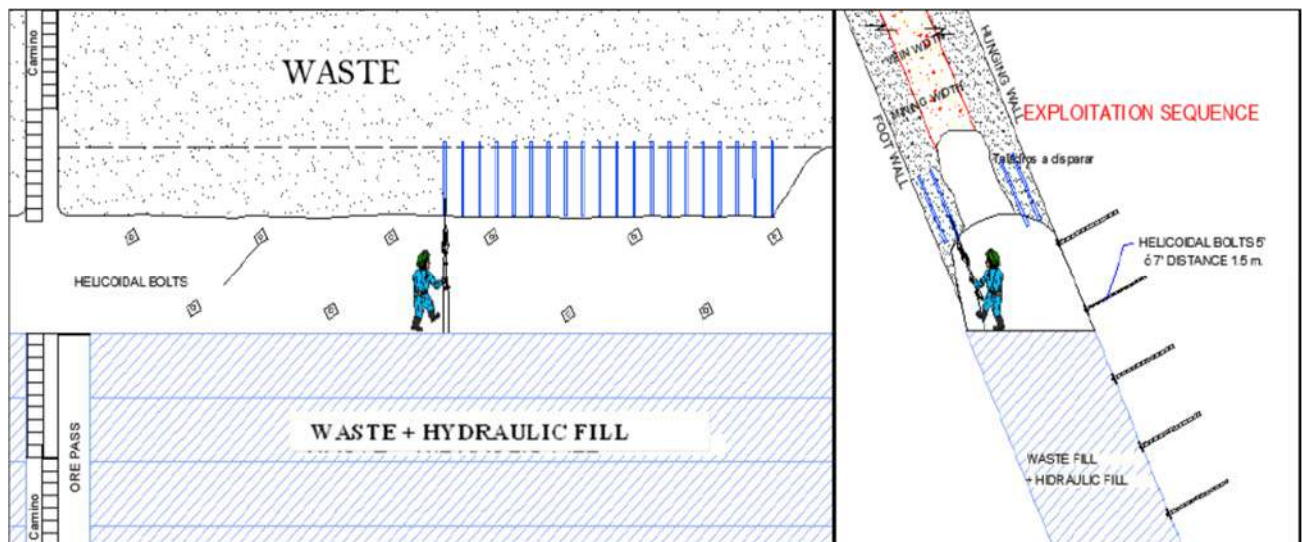
The semi-mechanized mining sequence is shown in Figure 16.2 and involves: drilling (with jacklegs), blasting, support, loading and haulage. Depending on vein width, once the ore has been extracted the walls have to be drilled and blasted in order to allow the minimum working width, especially for the loading equipment.

**Figure 16.2 Semi-mechanized mining sequence (continued on next page)**

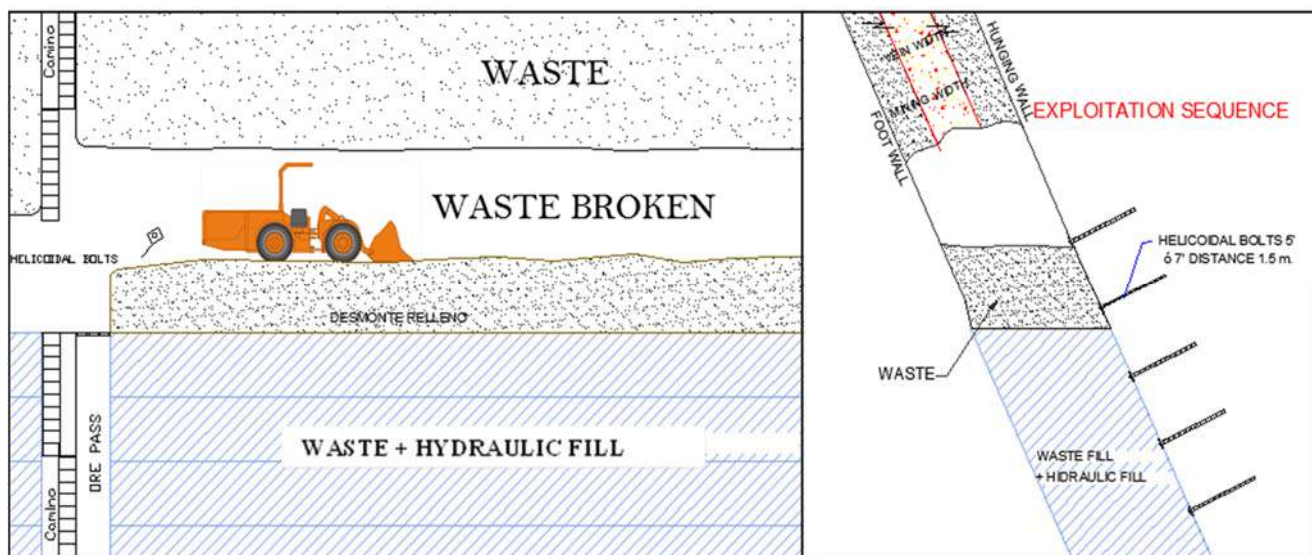




## ROCK WALLS DRILLING AND BLASTING



## WASTE AND HYDRAULIC FILL



### 16.3.3 Conventional cut-and-fill

Conventional mining is performed using handheld drilling equipment (jacklegs) and scrapers for loading. The ore haulage is done with trains and rail system and the support is applied with rock bolts in manual form. This system is applied in narrow veins with average widths between 0.5 m and 0.8 m.

## 16.4 Economic cut-off, dilution, mine plan, and stope design

### 16.4.1 Economic cut-off value

The initial stope design was based on an NSR cut-off value defined using a silver price of US\$19 per ounce, gold price of US\$1,140 per ounce, lead price US\$2,150 per tonne, and zinc price US\$2,300 per tonne, a process recovery of 84.5 percent for silver, 39.5 percent for gold, 92.6 percent for lead, and 89.9 percent for zinc, and NSR breakeven cut-off values of US\$82.73/t for Animas, US\$82.53/t for Animas NE, US\$97.07/t San Cristóbal; and US\$173.74/t for Bateas, Cimoide La Plata, La Plata, and Soledad. The operating costs were estimated based on actual operating costs incurred from July 2014 through June 2015. Minera Bateas used an in situ cut-off grade to design mining shapes in the resource block model. Mining shapes were interrogated with the mine planning software and checked against a cut-off grade that includes an allowance for internal dilution.

Dilution is defined as follows:

$$\text{Dilution} = \text{Tonnes waste mined} / (\text{Tonnes ore mined} + \text{Tonnes waste mined})$$

### 16.4.2 Mine plan

The underground mine plan targets only Measured and Indicated Mineral Resources. Where Inferred Mineral Resources have been unavoidably included within mining shapes they have been treated as waste and assigned zero grades.

At the selected mine planning cut-off grade there are 1.98 Mt of Measured and Indicated Mineral Resources at an average grade of 121 g/t silver, 0.3 g/t gold, 2.83 % lead, and 3.55 % zinc. Minera Bateas defines potential reserves as all Measured and Indicated Resources that have NSR values above the mine planning cut-off value.

### 16.4.3 Stope design

The exploitation infrastructure required to service mechanized mining is similar to that used to service semi-mechanized mining. This includes a center ramp connecting to sub level development running parallel to the vein. A cross cut from the sub level is developed to intersect the vein perpendicularly and allow exploitation. Each cross cut allows the exploitation of a 150 m long stope by mechanized mining or a 90 m long stope by semi-mechanized mining. Additionally, development may include raises used for ventilation, service systems or as ore passes adjacent to stopes.

Conventional mining requires less development. A center raise is driven in the vein to allow access for exploitation and extraction, giving access to a 60 m long stope (30 m each side of the raise). Two additional raises allow for access, ventilation and services.

## 16.5 Underground mine model

### 16.5.1 Mine layout

The mine plan includes a program for mine development which can be divided into three types: 1) development, 2) stope preparation and 3) exploration. In order to produce 1,500 tpd, approximately 700 m of new development is required each month. Development includes infrastructure such as ore passes, ramps, bypasses, and ventilation raises; preparation consists of all workings for exploitation purposes; and mine exploration is to assist with the exploration of the veins.



### 16.5.2 Lateral development

A summary of the lateral development requirements for the life-of-mine are detailed in Table 16.1. Lateral development totals 20,711 m, equivalent to a development ratio of 100 t/m.

**Table 16.1 Summary of lateral development requirements**

Activity	2016	2017	2018	2019	Total
By pass (m)	565	471	785	0	1,821
Drift (m)	1,180	707	812	549	3,248
Gallery (m)	286	120	40	369	815
Ramp (m)	2,207	1,771	1,769	1,424	7,172
Sub Level (m)	892	1,461	756	326	3,436
Stope access (m)	1,930	1,052	736	501	4,219
<b>Total (m)</b>	<b>7,061</b>	<b>5,582</b>	<b>4,898</b>	<b>3,170</b>	<b>20,711</b>

### 16.5.3 Raising requirements

Table 16.2 is a summary of life-of-mine (LOM) raising requirements. With vertical development totaling 5,345 m, these are all ventilation raises.

**Table 16.2 Summary of vertical development requirements**

Activity	2016	2017	2018	2019	Total
Chimney (m)	389	645	1,346	543	2,923
Raise bore (m)	665	301	743	712	2,422
<b>Total</b>	<b>1,053</b>	<b>946</b>	<b>2,090</b>	<b>1,255</b>	<b>5,345</b>

## 16.6 Production and development schedule

The mining production period extends from Q1 2016 to Q4 2019, or 3.9 years. At full production the planned mining rate is 1,500 tpd (510,510 tonnes per annum). Planned life-of-mine ore production is 1.98 Mt at an average silver grade of 122 g/t, gold grade of 0.3 g/t, lead grade of 2.83 %, and zinc grade of 3.55 % (see Table 16.3).

**Table 16.3 Production schedule**

	Vein	2016	2017	2018	2019	Total
Tonnes	Animas	503,100	510,510	445,793	394,922	1,854,326
	Bateas	0	0	34,300	0	34,300
	Cimoide L a Plata	0	0	18,035	0	18,035
	La Plata	0	0	12,382	0	12,382
	San Cristóbal	0	0	0	43,940	43,940
	Soledad	0	0	0	15,340	15,340
	All	503,100	510,510	510,510	454,203	1,978,323
Ag (g/t)	All	87	88	188	126	122
Au (g/t)		0.24	0.20	0.38	0.41	0.30
Pb (%)		3.36	3.32	2.48	2.07	2.83
Zn (%)		3.90	4.15	2.93	3.16	3.55
Width (m)		4.97	5.43	4.79	5.24	5.10

Development advance rates have been planned to take into account potential bottlenecks such as available ventilation, capacity to move muck, congestion in the main ramp, and the availability of trained operating and maintenance crews. Development

meters required for production per year, in accordance with the production schedule is detailed in Table 16.4.

**Table 16.4 Development schedule**

Vein	Type	2016	2017	2018	2019	Total
Animas	Horizontal (m)	1,904	1,054	1,031	276	4,265
	Incline (m)	5,158	3,061	2,111	1,533	11,863
	Vertical (m)	1,053	139	565	520	2,277
<b>Total Animas (m)</b>		<b>8,115</b>	<b>4,255</b>	<b>3,707</b>	<b>2,329</b>	<b>18,405</b>
Bateas	Horizontal (m)	0	781	415	0	1,196
	Incline (m)	0	200	470	0	670
	Vertical (m)	0	621	848	0	1,469
<b>Total Bateas (m)</b>		<b>0</b>	<b>1,601</b>	<b>1,734</b>	<b>0</b>	<b>3,335</b>
La Plata, Cimoide La Plata	Horizontal (m)	0	285	190	0	475
	Incline (m)	0	200	334	0	534
	Vertical (m)	0	186	385	0	572
<b>Total La Plata, Cimoide La Plata (m)</b>		<b>0</b>	<b>672</b>	<b>909</b>	<b>0</b>	<b>1,581</b>
San Cristóbal	Horizontal (m)	0	0	307	582	889
	Incline (m)	0	0	40	89	129
	Vertical (m)	0	0	292	467	758
<b>Total San Cristóbal (m)</b>		<b>0</b>	<b>0</b>	<b>638</b>	<b>1,138</b>	<b>1,776</b>
Soledad	Horizontal (m)	0	0	0	188	188
	Incline (m)	0	0	0	501	501
	Vertical (m)	0	0	0	269	269
<b>Total Soledad (m)</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>958</b>	<b>958</b>
<b>Total all veins (m)</b>		<b>8,115</b>	<b>6,528</b>	<b>6,988</b>	<b>4,425</b>	<b>26,055</b>

## 16.7 Equipment and manpower

### 16.7.1 Underground development

The underground mine is operated by a mining contractor selected by Minera Bateas based on a competitive bidding process. The scope of work for the mining contractor generally includes mine decline and raise development, stope preparation development, stoping, backfilling, and all related services required for the operation of a 1,500 tpd narrow vein silver-gold-lead-zinc mine.

### 16.7.2 Mining equipment

Table 16.5 shows Minera Bateas's estimate of the mining fleet required to execute the mine plan including the supporting surface units. The maximum number of units is shown for each equipment type, as actual equipment requirements vary throughout the mine life.

Replacement equipment required during the mine life is not included in the list shown.

**Table 16.5 Planned mining equipment**

Equipment	Quantity	Type	Model	Capacity
Scoop	8	Cat	R1300 LHD	4.2 yd <sup>3</sup>
Scoop	1	Paus	PFL-18	2.5 yd <sup>3</sup>
Scoop	1	Wagner	ST2D	2.5 yd <sup>3</sup>
Scoop	1	Sandvik	LH 201	0.75 yd <sup>3</sup>





Equipment	Quantity	Type	Model	Capacity
Jumbo	5	Sanvik	DD310	1 Brazo
Jumbo	1	Atlas Copco	ROCKET - BOOMER 281	1 Brazo
Locomotive	1	Clayton	CLAYTON 2D	3.5 t/80V DC
Truck	11	Volvo	FMX	15 m3
Tractor	1	Komatsu	D39EX-22	-
Excavator	1	Cat	329DL	2.4 m3
Mixcret	3	Putzmeister	MIXCRET 4	4 m3
Robot Lanzador	2	Putzmeister	SPM 4210	250 L

### 16.7.3 Mine manpower

Minera Bateas estimates a total of 912 employees are required for underground mine related activities during the production period of the mine, comprised of 576 contractors and 336 Minera Bateas staff.

## 16.8 Mine services and infrastructure

### 16.8.1 Production drilling

#### **Mechanized**

For mechanized drilling, Minera Bateas uses a jumbo drilling machine, with the drilling taking place in horizontal benches (breasting) with average advances of 4.5 m and vertical drilling (raise) with average advances of 2.5 m. The minimum mining width varies according to the thickness of the vein. Production starts from the lower level and proceeds to higher levels of the stope by leaving an intermediate 3-meter bridge between stopes for safe operating conditions.

The production drill holes for breasting and raise drilling use drill pipe of 10 ft length and drill bits of 51 mm and 45 mm.

The drilling pattern varies according to the hardness of the rock and type of cut.

#### **Semi-mechanized**

For semi-mechanized drilling, Minera Bateas uses handheld drilling equipment (jacklegs). Similar to the mechanized drilling, the drilling takes place in horizontal benches (breasting) with average advances of 2.5 m and vertical drilling (raise) with average advances of 1.8 m. The minimum mining width varies according to the thickness of the vein. Production starts from the lower level and proceeds to higher levels of the stope by leaving an intermediate 3-meter bridge between stopes for safe operating conditions.

The production drill holes for breasting and raise drilling use drill pipe of 8 and 6 ft lengths and drill bits of 41 mm.

The drilling pattern varies according to the hardness of the rock and type of cut.

#### **Conventional**

For conventional drilling, Minera Bateas uses handheld drilling equipment (jacklegs). The drilling takes place with vertical raise drilling with average advances of 1.8 m. The minimum mining width varies according to the thickness of the vein. Production starts from the lower level and proceeds to higher levels of the stope by leaving intermediate 3.0 meter bridges between stopes for safe operating conditions.

Production drill holes for raises use drill pipe of 4 and 6 ft lengths and drill bits of 41 mm.

The drilling pattern varies according to the hardness of the rock and type of cut.

### 16.8.2 Ore and waste handling

A combination of 4.2 yard Load-Haul-Dump (LHD) units, 40 t trucks and railcars were selected as being the most economical option for ore and waste haulage. For the mechanized mining methods, broken ore from the stopes is mucked by LHDs to an ore pass, or loaded directly into 40 t trucks. Waste rock from development headings is mucked by LHDs directly to the trucks or to local waste storage areas. The waste rock is then hauled by the trucks to the surface storage facilities near the portal. As underground mine production continues, mine waste rock from development is used as stope backfill along with the waste rock from the surface. Trucks are used to bring backfill material from the surface to mined-out stopes. This material consists of underground waste material that has been temporarily stored on surface due to stope timing issues.

For stopes using conventional mining methods, the railway system is used to transport ore and waste material coming from stopes to the main ore and waste passes.

### 16.8.3 Mine ventilation

The estimated air flow required for the Animas underground mine is 483,350 cfm for a production rate of 1,500 tpd based on the utilization of the planned mining equipment. Air intake is through the main access ramp for the levels 6, 7, 8, 9 and 12 which represents an estimated 452,822 cfm. Air is exhausted from three main raises (one of 120,000 cfm and two of 100,000 cfm) for a total of 320,000 cfm.

Auxiliary fans move fresh air from the ramps with ducting along the level access crosscuts and along the vein to active work areas.

### 16.8.4 Backfill

Backfill required by the mine to complete the mining sequence is provided by waste rock and classified mill tailings. While waste rock backfill is generated by underground development, the quantity produced is generally insufficient to meet mine backfill requirements. To supplement the waste rock from development activities, classified mill tailings or hydraulic backfill is produced by a small plant on the surface. The proportion of waste and hydraulic backfill is 28 percent and 72 percent, respectively. The total volume of backfill required by the mine is estimated to be 206,000 m<sup>3</sup> per annum.

### 16.8.5 Mine dewatering system

The underground mine dewatering system has been designed to handle an estimated peak rate of 200 l/s.

The dewatering of the Animas vein is primarily through a sump located at station 1 in Animas level 13 with a capacity of 900 cubic meters equipped with two submersible pumps capable of handling 200 l/s.

Station 2 in Animas level 14 has three auxiliary submersible pumps capable of handling 45 l/s each, giving a total of pumping capacity of 110 - 120 l/s.

Water is pumped through high-density polyethylene (HDPE) cased boreholes (305 mm inside diameter) from Animas level 13 (CH462N) to a sump located in RP527N and

CX459S with a capacity of 1,000 cubic meters and then pumped to the portal of Animas level 12 where the water is treated to avoid any environmental contamination.

#### 16.8.6 Maintenance facilities

Maintenance facilities for the underground mobile fleet consist of a surface maintenance shop for major failures of the equipment and two underground work shops for minor repairs and lubrication performed as part of the preventive maintenance program.

#### 16.8.7 Electrical power distribution

Power to support the mine infrastructure is provided from the main site electrical substation via a 15 kV line connected to the national power grid line from Callalli via a 66 kV line. Minera Bateas signed a contract with Distribution Company ENGIE for the electricity supplied.

Electrical energy requirements for the Minera Bateas operation are as follows; plant concentrator 2,600 kilowatts; mine 2,100 kilowatts; and general services and camp 500 kilowatts, with a total of 31 electrical substations distributed throughout the operation area to meet the electrical power demand.

##### Primary line

Minera Bateas has two overhead 15 kV transmission lines from the Caylloma substation to the onsite substation located at the power distribution room.

##### Secondary line

The main onsite substation distributes electrical power to the main operational centers via overhead 15 kV lines to:

- Plant concentrator
- Animas vein
- Bateas vein

There are three substations. Substation No. 29 (15/3.2 kV), located on the surface, distributes electric power to production and mine development activities. Substation No. 16 (3.2/0.44 kV), located on Level 12 of the mine, distributes electric power to mine equipment such as fans, jumbos, and pumps. Substation No. 5 (3.2/0.44/0.22 kV), located at the Camp Santa Rosa, distributes electric power with an overhead of 15 kV to 3.2 Kv, via a transformer of 1,600 Kva, to distribute 440 and 220 V electricity to the camp and administrative areas.

In addition, Minera Bateas maintains three backup power sources to generate electric power by using diesel power generation to cover the Animas demand for ventilation and water pumps of the level 7 NE and the water pump on Animas Level 13 as detailed below:

- GE01: Cummins C900D6 of 550 kW, 0.46 kV, connected to Substation No. 08
- GE02: Cummins C2000D6 of 1.2 MW (1,200 kW), 0.46 kV, connected to Substation No. 02
- GE03: Cummins GEC15 of 800 kW, 0.46 kV, connected to the Substation No. 29



#### 16.8.8 Other services

##### **Compressed air supply**

Average compressed air consumption during the mine production is estimated at approximately 1,000 cfm. The compressed air is supplied from the surface by air compressors (one electric and two diesel powered). These provide compressed air of 85 psi for the development and mining activities.

## 17 Recovery Methods

The Minera Bateas processing plant is a typical flotation operation and consists of five stages: crushing; milling; flotation; thickening and filtering and tailings disposal. Each of the main stages is comprised of multiple sub-stages. A summary of each stage is as follows:

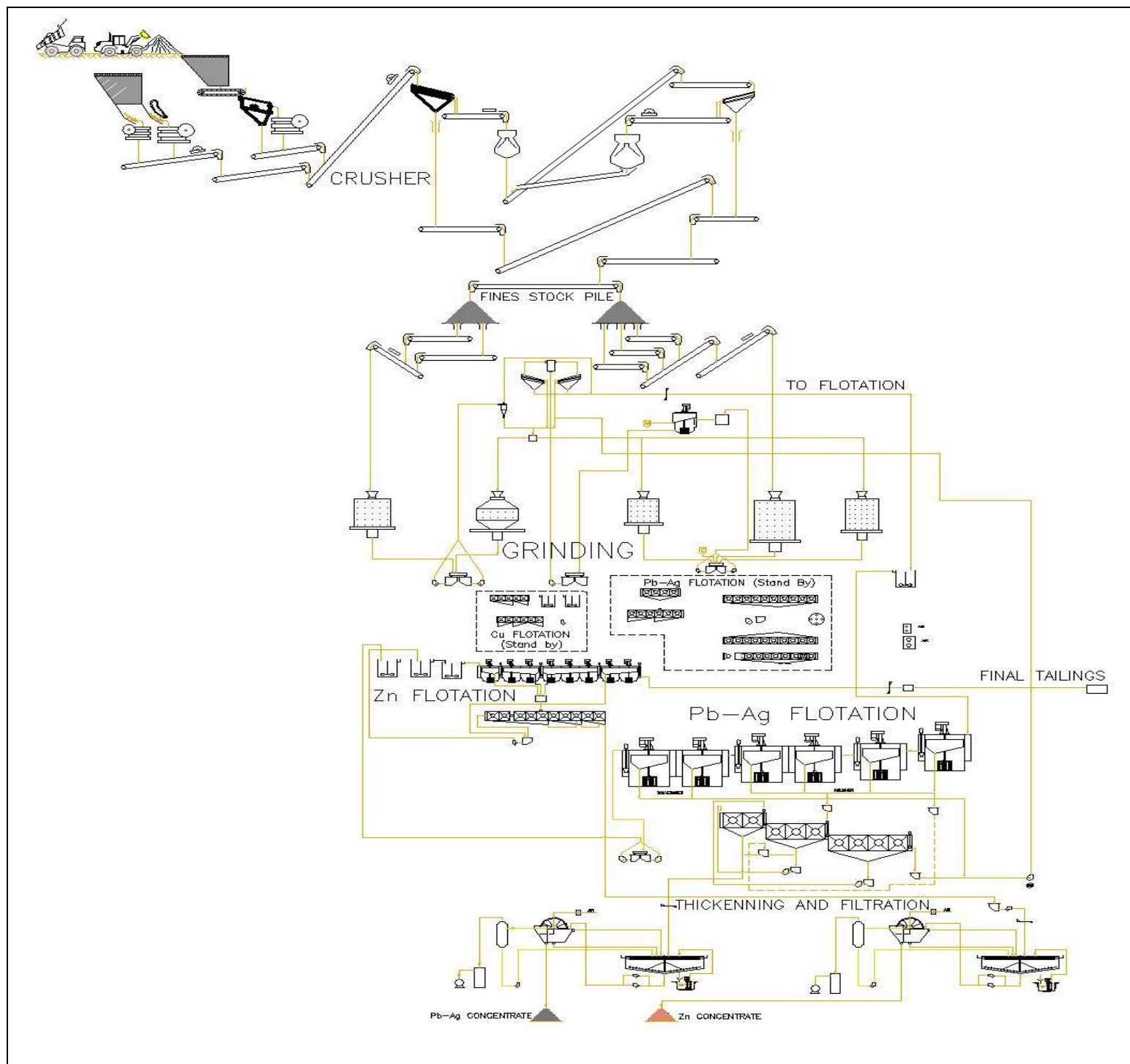
- **Crushing:** includes three stages, primary, secondary, and tertiary
- **Milling:** includes two stages, primary and secondary
- **Flotation:** consists of two operating flotation circuits (Lead-Silver, and Zinc) and one copper flotation circuit on standby
- **Thickening and filtering** is performed separately for the concentrates, which after filtering undergo a drying process before being placed in their respective storage bins to await transportation
- **Tailings disposal:** Final tailings are classified through cyclones. The coarse fraction (underflow) is placed onto a concrete pad and transported to the mine to be used as hydraulic fill. The finer fraction (overflow) is pumped to the tailings storage facility

The Caylloma concentrator plant resumed operations in September 2006, treating 600 tpd of polymetallic mineral. Capacity increased progressively, with the installation of a 1.8 m by 2.4 m ball mill in 2009 the plant reached a treatment capacity of 1,300 tpd, and with the installation of two Derrick Stack Sizer vibrating wet screens the plant achieved a treatment capacity of 1,500 tpd at the end of March 2016, although this has since been reduced to 1,430 tpd for the rest of 2016. The treatment process is differential flotation. Initially, two concentrates were obtained: lead-silver and zinc. From late 2009 to January of 2011, a copper-silver concentrate was also produced, but due to unfavorable commercial terms the production of copper concentrate was suspended and the copper circuit put on standby.

### 17.1 Crushing and milling circuits

The crushing and milling circuits are shown in Figure 17.1. The crushing process is fed from the 10,000 t capacity stock pile used for ore storage and blending. The process commences with feed to the coarse hopper, which has a 450 t active capacity with 30 cm separation grates. The mineral is extracted from the coarse hopper through the apron feeder that feeds the vibrating grizzly with variable separation that, in turn, feeds the Kurimoto jaw crusher, resulting in a product size varying between 76 mm and 90 mm. The mineral is transported on two conveyor belts (1-A and 2-A) to the two-deck vibrating 6 by 14 foot screen. The screen's undersize is fed to the stockpile through belts 3-A, 17, 3, 4, and 15 with the oversize going to a Sandvik CH-420 secondary crusher through belt 4-A, the product of which goes to the two-deck vibrating 5 by 14 foot screen through belts 1 and 18, the undersize of this screen feeds the stockpile through belts 3, 4 and 5. The oversize is fed through conveyor belt 2 to the Sandvik CH-430 tertiary crusher, the discharge of which returns to belt 1, closing the circuit.

**Figure 17.1 Crushing and milling circuits at the Caylloma processing plant**



Additionally, there is a standby primary crushing circuit that starts at a 100 t capacity coarse hopper. From the hopper, the mineral is fed to a Kueken 24 by 36 inch jaw crusher through a Ross chain feeder. The discharge from this crusher is transported via

conveyors 19 and 20 to conveyor 2-A. There are three permanent magnets and one electromagnet on the conveyors to prevent the entry of tramp iron.

The grinding circuit has two stages. The primary stage operates in an open circuit, consisting of two ball mills (Comesa 2.4 m by 3.0 m and a Denver 2.1 m by 2.1 m). The secondary stage operates in closed circuit and consists of three ball mills, a Magensa 1.8 m by 1.8 m, a Hardinge 2.4 m by 0.9 m and a Liberty 1.8 m by 2.4 m. The final product of the grinding circuit is 60 percent passing 75 microns.

The Comesa and Denver primary grinding mills are fed independently by conveyor belts. The Comesa primary mill operates with the Magensa and Libertad secondary mills. The Comesa mill discharge feeds a flash cell (SK 240) with concentrate from the flash cell being sent to the lead thickener. Tailings are fed to a 6 by 6 inch horizontal pump which in turn feeds the Derrick Stack Sizer. The undersize goes to the flotation circuit and the oversize feeds the three secondary ball mills.

The Denver primary ball mill operates with the Hardinge secondary ball mill. Discharge from this mill feeds a 6 by 4 inch horizontal pump, which in turn feeds the D-15 cyclone. The cyclone's overflow goes to the flotation circuit and the underflow returns to the three secondary ball mills.

## 17.2 Metallurgical treatment

Metallurgical treatment is through a process of differential flotation; the first step is the flotation of lead-silver followed by zinc flotation.

### Lead-silver flotation circuit

The D-15 cyclone overflow and the Derrick Stack Sizers undersize are fed to a conditioner before going to the TC-20 unit cell of 20 m<sup>3</sup> capacity. The unit cell tailings are fed to three TC-20 rougher cells. The unit cell concentrate together with the rougher concentrate are fed to the primary cleaner cells, consisting of four 3 m<sup>3</sup> OK-3 cells. The primary cleaner concentrate is fed to the secondary cleaner cells, consisting of three 3 m<sup>3</sup> OK-3 cells. The secondary cleaner concentrate is fed to the tertiary cleaner cells, consisting of two 3 m<sup>3</sup> OK-3 cells. Concentrate from the tertiary cleaner forms the final lead-silver concentrate. Tailings from the secondary and tertiary cleaner cells return to the head of the primary and secondary cleaner cells, respectively.

The rougher tailings feed the scavenger flotation bank, consisting of two TC-20 cells. The scavenger concentrate, as well as the primary cleaner tailings are pumped to join the Derrick Stack Sizers with oversize returning to the secondary grinding circuit. The scavenger tailings feed the zinc flotation circuit.

### Zinc flotation circuit

The lead-silver flotation tailings are sent to three conditioners (two 2.4 m by 2.4 m, one 3.0 m by 3.0 m). The conditioned pulp is fed to the zinc rougher flotation stage, consisting of six 8 m<sup>3</sup> OK8U cells working in series. The rougher concentrate is fed to the cleaner flotation circuit, comprised of three stages consisting of five, three and two 2.8 m<sup>3</sup> Sub-A30 cells for the primary, secondary and tertiary cleaner stages respectively. These stages work in series, the concentrate from the primary cleaner feeds the secondary cleaner and the concentrate of this feeds the tertiary cleaner. The concentrate from the latter is the final product from the zinc flotation circuit. The zinc concentrate goes through an automatic sampler and is then sent to the zinc thickener.



The rougher tailings feed the scavenger flotation circuit that is comprised of two 8 m<sup>3</sup> OK8U cells. The scavenger concentrate is sent to a conditioner before returning it to the rougher circuit. The scavenger tailings are the final tailings of the whole process.

The flotation process achieves a lead concentrate containing an average of 55 percent lead and a zinc concentrate containing an average of 51 % zinc. Historical data show achievable metallurgical recoveries of 91 percent for lead, 81 percent for silver (in the lead concentrate) and 87 percent for zinc.

#### Concentrates thickening and filtration

The lead-silver concentrate is thickened in an Outotec 9.0 m diameter thickener; the underflow is pumped to a 1.8 m diameter disc filter (six discs). The filtered lead concentrate contains on average 7.5 percent moisture.

The zinc concentrate is thickened in an Outotec 12.0 m diameter thickener; the underflow is pumped to a 1.8 m diameter disc filter (eight discs). The filtered zinc concentrate contains on average 9.0 percent moisture.

Each filtered concentrate is discharged into a covered temporary storage area from where it is loaded by a front-end loader into trucks for transport to the concentrate purchaser's storage facilities in Matarani, Arequipa for the zinc concentrate and Callao, Lima for the lead-silver concentrate.

#### Tailings disposal

Tailings from the concentration process are pumped and classified through cyclones. The underflow is accumulated in a temporary storage area for later transportation to the mine as hydraulic backfill. Approximately 35 percent of the tailings are used as backfill material in the mine.

The overflow is pumped to the tailings facility for final disposal. The water collected from the tailings impoundment is pumped back to the processing plant and reused in the process. Usage of the new tailings storage facility (N° 3) commenced in January 2013.

### 17.3 Requirements for energy, water, and process materials

Electric power requirements are supplied through the Callalli substation from the national grid. The whole operation requires 5.1 megawatts of energy including 1.8 megawatts required by the processing plant. The operation also keeps three diesel generators on site as a backup power supply in case of emergencies.

The processing plant water consumption is 2.20 m<sup>3</sup>/t. Approximately 70 percent (1.54 m<sup>3</sup>/t) is recovered from the tailings facility and pumped back to the plant to be re-used in the process along with 30 percent (0.66 m<sup>3</sup>/t) fresh water.

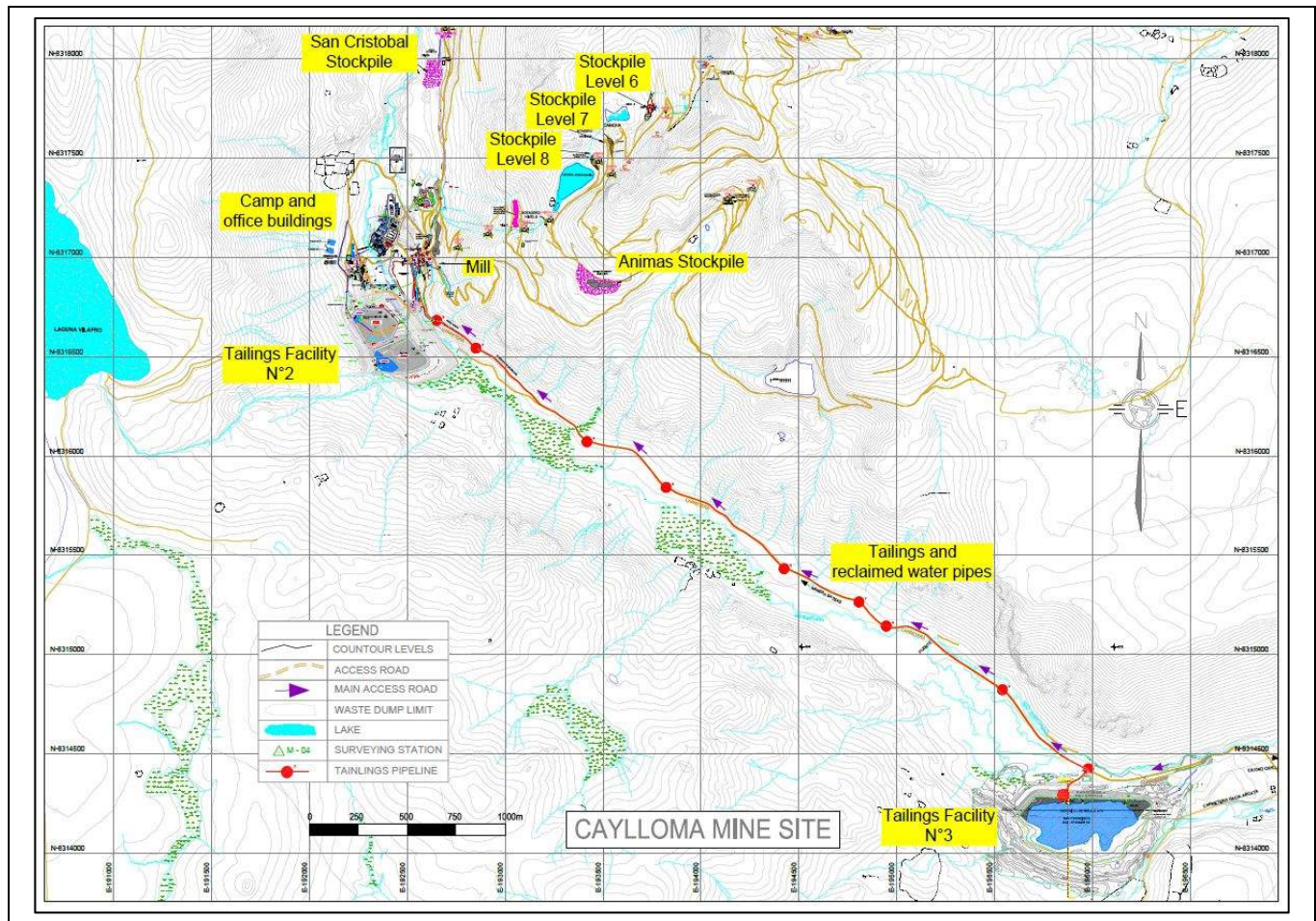
All process materials are available from Arequipa and Lima. Reagents are provided from local service representatives representing international reagent suppliers.



## 18 Project Infrastructure

The Caylloma Property has a well-established infrastructure used to sustain the operation. The infrastructure includes a main access road from the city of Arequipa, property access roads, tailing storage facilities, mine waste storage facilities, mine ore stockpiles, camp facilities, concentrate transportation, power generation and communications systems (Figure 18.1).

**Figure 18.1 Plan view of mine camp**



### 18.1 Roads

Roads on the property are shown in Figure 18.1. Access roads are unpaved but are in good condition due to regular maintenance. Water tankers are used in summer to dampen the roads to reduce dust pollution. Roads interconnect all the facilities on the property and allow access through various portals to the underground operations.

## 18.2 Tailing storage facilities

The mine currently operates two tailings storage facilities, Tailings Deposit N° 3 and Tailings Deposit N° 2. The first, is the main and biggest facility where most of the tailings are sent.

The Tailings Deposit N° 3 operation permit was issued by the Ministry of Energy and Mines in December 2012. According to the 2016 plant treatment capacity of 1,500 tpd and mine backfill demand, the first stage facility, constructed in two phases (1A and 1B) in 2012, with a tailings embankment elevation of 4,415 masl, will provide a total capacity of almost six years. The second stage is planned to be constructed in 2018 and should provide capacity for an additional nine years of operation.

The South embankment of the Tailings Deposit N° 2 (4,474 masl) provides a small additional capacity (three months) as a contingency plan for tailings storage. The elevation of the north embankment has already been approved by the Ministry of Energy and Mines and should be constructed in 2017 giving an additional six month's capacity.

## 18.3 Mine waste stockpiles

The mine currently operates one waste stockpile, Bateas Level 12, which is used for storing waste material that could not be effectively disposed underground. The current waste stockpile capacity is two years, a project for a new facility to be constructed in 2017 is under evaluation.

## 18.4 Ore stockpiles

The mine currently has four ore stockpiles which store mine production, oversized, low grade and already crushed ore. The total stockpile capacity is approximately 45,000 tonnes. The total stockpile tonnage as of December 2015 was 26,000 tonnes.

## 18.5 Concentrate production and transportation

In March of 2015, the Processing Plant Optimization Project (POP) was initiated to increase the processing capacity from 1,300 to 1,500 tpd by improving the grinding and flotation circuits. The total investment in the project was US\$ 4.6 million and the project was concluded in March 2016. The plant currently operates at 1,430 tpd pending some adjustments and test work with the intention of returning to 1,500 tpd in 2017.

Concentrate transportation is carried out using 30 tonne capacity trucks. Before the trucks depart camp they are weighed at the truck scale. All trucks are systematically registered and controlled so that the delivered concentrate weighed at the storage port reconciles with that which left the mine.

## 18.6 Power generation

The power demand on the mine site is 4.3 MW on average, power supply is obtained mainly (74 percent) through the national power grid. The mine site also maintains three diesel generators on site with a total capacity of 2.2 MW to cover the shortage (26 percent) and also as backup.

In October of 2015, Minera Bateas initiated work to increase the power supply capacity from 3.2 MW to 7.1 MW, although it would still be restricted by contract with the

power transmission company to 5.2 MW. The project includes a new 15 kV power line and the installation of a new 7.5 MVA transformer which will replace the current 3.5 MVA transformer. This project was concluded in January 2016. The estimated average power demand with the Processing Plant Optimization Project (POP) is 4 MW.

## 18.7 Communications systems

The Caylloma mine site is equipped with cellular phone and internet connection provided by local suppliers. The cellular phone signal is provided by an antenna located in the Caylloma District (approximately 6 km from the mine) and sent to the mine via microwave. The signal is captured by an amplifier and sent to the camp via a relay station located in the top level of the mine. The internet signal is provided through optic fiber to Callalli (approximately 75 km from the mine) and sent to the camp via microwave. Along with the internet signal the camp also gets fixed telephone service and data link.

Camp facility improvement works started at Caylloma in December 2011 with the construction of new offices and a consolidated mess hall. The works continued in 2012 with the construction of a new worker's camp and related facilities. This stage of the project concluded in December 2013.

In November 2014 a new laboratory building was completed. This new building replaced the old one with a more appropriate work area, configuration, and equipment. The total investment for this facility was US\$ 650,000.

## 18.8 Water supply

The fresh water supply for the Caylloma Mine is provided by the Santiago River which runs through the property. The permanent water permit was granted by the Ministry of Autoridad Nacional de Agua. Currently, the fresh water demand is 60 liters per second, including 10 liters per second for the camp.

Approximately 70 percent of the processing plant total water consumption is recovered from the Tailings Storage Deposit N° 3 and pumped back to the plant for reuse in the process along with 30 percent fresh water.

## 19 Market Studies and Contracts

In 2015, Minera Bateas signed a contract with Trafigura Peru S.A.C. to provide 21,000 wet tonnes of zinc concentrate. Another contract for 21,000 wet tonnes of lead concentrate was signed with Glencore Perú S.A.C. Those quantities represent the estimated concentrate production of the Caylloma Mine from January to June 2016.

For the period July to December 2016, Minera Bateas has agreed to a contract with Glencore Perú S.A.C. to provide 15,600 wet tonnes of lead concentrate. Minera Bateas has also agreed to contracts with Trafigura Perú S.A.C. and Andina Trade S.A.C. to provide 10,700 wet tonnes of zinc concentrate to each, respectively.

All the commercial terms entered between Minera Bateas and Glencore, Trafigura and Andina Trade are within the standards and industry norms.

Edwin Gutierrez, a Qualified Person as defined by NI 43-101, has reviewed the aforementioned agreements and has ensured that the results support the assumptions used in this Technical Report.

## **20 Environmental Studies, Permitting and Social or Community Impact**

### **20.1 Environmental compliance**

Minera Bateas operates pursuant to environmental regulations and standards set out in Peruvian law, and are in compliance with all laws, regulations, norms and standards for each stage of the mine's operation.

### **20.2 Environmental considerations**

Minera Bateas is in compliance with Environmental Regulations and Standards set in Peruvian Law and has complied with all laws, regulations, norms and standards at every stage of operation of the mine.

The Caylloma operation (legally referred to as the Economic Management Unit of San Cristóbal) has fulfilled its PAMA (Program for Environmental Compliance and Management) requirements, as approved by the Directorial Resolution No. RD 087-97-EM/DGM dated June 3, 1997 as set out by the Ministry of Mines.

The PAMA identified a number of programs to complete in order for the operation to conform to regulations and standards. The main projects outlined in the PAMA program were: the construction of a retaining wall at the base of the old tailings storage deposit, vegetation of the old tailings deposit, building a retaining wall at the base of the active tailings storage deposit and monitoring and treatment of mine water. The budgeted cost of the program was US\$365,000.

In 2002 the Ministry of Mines through the Mining Inspection Department conducted an audit of the programs specified in the PAMA document and approved on November 8, 2002 with a formal resolution 309-2002-EM/DGM RD.

The regulations required the approval of the mine closure plan, at a conceptual level, which was approved by WSF Directorial Resolution No. 328-207 MEM / AAM dated 10th December, 2007 by the Ministry of Mines.

The mine closure plan was approved by Executive Resolution No. 365-2009-MEM/AAM dated November 13, 2009. On November 12, 2012 Minera Bateas filed a request for modification and update to the mine closure plan in accordance with mine closure regulations.

The Sanitary Authorization for Treatment System Water was approved with Directorial Resolution No. 2307-2009/DIGESA/SA on May 18, 2009.

An Environmental Impact Study for the "Expansion of Mine and processing plant Huayllacho to 1,500 tpd from 1,030 tpd" was approved with Directorial Resolution 173-2011-MEM/AAM dated June 8, 2011.

The Ministry of Energy and Mines, by Resolution N° 351-2010-MEM-DGM/Vn dated September 9, 2010 authorized the use of Tailings Deposit N° 2 for tailings disposal.

On December 20, 2012, the Ministry of Energy and Mines, by Resolution N° 0274-2012 MEM/DG, authorized the use of Tailing Deposit N° 3 Stage 1A for tailings disposal up to the 4,410 masl elevation.

The upgrade of the mine closure plan was approved by Resolution N° 085-2013-MEM-AAM., dated March 22, 2013.

On September 2, 2013 by Resolution N° 459-2013-MEM/AAM., approved modification of Environmental Impact Study "Expansion of Mine and processing plant Huayllacho, project primary electric line SE Caylloma-Bateas 15 kV".

On September 30, 2014 by Resolution N° 492-3014-MEM-DGAAM., approved modification monitoring program – Point Monitoring water tailings, Tailing N°3 of the UEA San Cristobal.

On January 13, 2014, the Ministry of Energy and Mines, by Resolution N° 0015-2014-MEM-DGM/V., approved the South side elevation (From 4,470 to 4,474 masl) of the Deposit Tailings N° 2, pending the elevation and operation, of the north side of the facility.

On June 15, 2014, the Ministry of Energy and Mines, by Resolution N° 0216-2014-MEM- DGM\_V, authorized the elevation and use of Tailings Deposit N° 3 Stage 1B up to the 4,415 masl elevation.

On July 3, 2015, the Ministry of Energy and Mines, by Resolution N° 0750-2015-MEM/DGM, approved the Minera Bateas request to extend the “Huayllacho” concession area from 73.63 to 91.12 Ha to include some additional facilities.

On December 1, 2014, the Ministry of Energy and Mines, by Resolution 588-2014-MEM-DGAAM, approved the closure of 25 mining environmental liabilities from old operations located within the Minera Bateas mining concessions.

On August 21, 2015, the Ministry of Energy and Mines, by Resolution N° 327-2015-MEM/AAM, approved the Mine Closure Plan modification requested by Minera Bateas.

On April 8, 2015, the ANA (Acronym in Spanish for National Water Authority) by R. D. N° 0048-2015- ANA/AAA.XI-PA updated the authorization to use superficial water which covers the operational surface water demand.

In August 2012 Minera Bateas submitted to the Ministry of Mines and Energy (MEM) its “Environmental Quality Standards and Maximum Acceptable Limits Implementation Plan” complying with the MEM requirements and deadlines. No observations have been issued by the MEM as of the effective date of this report and approval is still pending.

## 20.3 Environmental permitting

The major permits that have been granted to allow Minera Bateas to operate at the Caylloma Property are as follows:

- The Caylloma Mining Unit (Administrative Economic Unity St. Cristobal) was granted under the Ministry of Mines Resolution No. 139-89-EM-DGM/DCM. The required minimum investment has been made and the permission is permanent in nature.
- The permit for mineral processing in the Caylloma District was granted by resolution of the Ministry of Mines dated October 21, 1908. This permit is permanent.



- Authorization of the treatment plant for operation was granted by Resolution No. 102-80-EM/DCFM, dated July 7, 1980. The permit is permanent.
- Authorization for direct discharge of effluent solids was granted on June 25, 2004 by Resolution No. 0744-2004-DIGESA/SA and is permanent.
- Authorization for the use of gasoline and diesel storage tanks was registered through resolution CDFJ No.001-04-2004, dated May 26, 2006. It is permanent.
- Authorization for the development of thermal power generation activities with energy above 500 kW was granted by order of the Ministry of Mines No. 391-2005-MEM/DM, dated September 12, 2005. The permit is permanent.
- The Tax Stability Agreement was granted for a period of ten years in relation to the investment plan detailed in the study of technical and economic feasibility (stability of the tax) through Executive Resolution No.370-2006 mine MEM-DGM, dated August 21, 2006.
- Authorization to restart activities in wastewater treatment plant was granted with issuance of resolution No.1078-2006-MEM-DGM / V, dated September 6, 2006. The permit is permanent.
- Directorial Resolution No. 1035-2007/DIGESA/SA of March 22, 2007, authorizes the usage of a sanitary system for domestic wastewater treatment and disposal in the ground, with permanent effect.
- Authorization for the Tailings Deposit N° 2 consistent with the approved mine closure plan through Resolution No. 351-2010-MEM-DGM / V.
- Authorization for the operation of the Huayllacho beneficiation plant was awarded by resolution of the Ministry of Mines PB-0015-2010/MEM-DGM-DTM, dated January 14, 2010. The permit is permanent.
- Authorization to operate the concentrator plant with an expanded capacity of 1,030 tpd was granted by resolution No. 007-2010-MEM-DGM / V, dated January 14, 2010. The permit is permanent.
- Authorization for the development of a 15 kV transmission was granted by order of the Ministry of Mines No. 052-2010-EM, dated August 21, 2010. The permit is permanent.
- Authorization for the Tailings Deposit N° 3 (Stage 1A, 4,410 masl) operation. Approved by Resolution N° 0274-2012 MEM/DG, dated December 20, 2012.
- Certificate of Non-Existence of Archaeological Remains of several components of the Caylloma mining unit, approved by CIRA No. 2012-172/MC, dated May 17, 2012.
- Authorization for the Tailings Deposit N° 2 embankment elevation (From 4,470 to 4,474 masl) approved by Resolution N° 306-2013 MEM-DGM/V, dated August 9, 2013.

- Authorization for the Tailings Deposit N° 2 elevated embankment (South side) operation. Approved by Resolution No. 0015-2014 -MEM-DGM/V dated January 13, 2014.
- Authorization for the Tailings Deposit N° 3 (Stage 1B, 4,415 masl) operation. Approved by Resolution N° 0216-2014 MEM-DGM\_V, dated June 15, 2014.
- The renewal of the Explosives Magazine License for ANFO product was approved by Executive Resolution No. 185-2014-IN-1703-2 as of July 24, 2014. It is currently processing a renewal application for authorization for five years.
- Authorization for treated industrial wastewater discharge from the Tailings Deposit N° 3 approved by Directorial Resolution N° 003-2015 ANA-DGCRH, dated January 8, 2015. The authorization is valid for three years.
- Authorization for water effluent discharge sample point E-03. Approved by Resolution N° 040-2015-ANA-DGCRH, dated February 13, 2015. The authorization is valid for four years
- Authorization for the use of fresh (surficial) water. Approved by the ANA (Acronym in Spanish for National Water Authority) with Directral Resolution N° 0048-2015 ANA/AAA.XI-PA, dated April 8, 2015.
- Authorization for treated industrial wastewater discharge from the equipment washing facilities, San Cristóbal and Animas Level 2, by Directorial Resolution N° 123-2015 ANA-DGCRH, dated May 11, 2015. The permit is valid for two years
- Authorization renewal for water effluent discharge sample points EF-3 and E-05. Approved by Resolution N° 123-2015-ANA-DGCRH, dated May 11th, 2015. The authorization is valid for two years.
- Authorization for the processing plant construction and operation with increased capacity to 1,500 tpd. Approved by Resolution N° 0539-2015-MEM-DGM/V, dated November 4, 2015.
- The Certificate for Mining Operations for 2016 (COM 2016) was granted on October 29, 2015 under resolution No. 015-2016-C.
- Authorization renewal for an underground ANFO magazine by Resolution N°. 00614-2016-SUCAMEC/GEP, dated March 21, 2016.
- Authorization renewal for water effluent sampling points E-04, E-08 and E-12. Approved by Resolution N° 083-2016-ANA-DGCRH, dated April 25, 2016. The authorization is valid for four years.
- The 2015 Consolidated Annual Declaration (DAC) was provided to the MEM on May 25, 2016.
- By Resolution No. 01373-2016-SUCAMEC/GEEP, dated June 24, 2016, SUCAMEC granted the authorization of explosive use for the second semester of 2016.

In addition to these norms and permits obtained from the environmental department, the operation also ensures all environmental activities are regularly monitored and

recorded as part of the quality control measures that are presented to the Ministry of Energy and Mining and other legal regulatory organizations.

Of particular importance is monitoring of the quality of river water in the area. This activity involves monitoring the Santiago River, being the main river that passes through the property, employing people from the local communities to verify the results.

In the case of water monitoring, Minera Bateas mine has eight points of control along the Santiago River. These sampling points were selected based on the likely discharge locations of the different levels of the mine and the concentrator plant. The samples obtained are sent to the ALS Chemex laboratories in Lima and Arequipa with the results being presented to representatives of the local community to confirm the water quality meets or exceeds the required standards.

Minera Bateas has also obtained and maintains its ISO 14001 Environmental Management Certification since 2008. The mine works continually to improve its operational standards.

## 20.4 Social or community impact

Minera Bateas has a very strong commitment to the development of neighboring communities of the Caylloma Mine. In this respect, Minera Bateas is committed to sustainable projects, direct support and partnerships that build company engagement in local communities while respecting local values, customs and traditions. The company aims to develop projects or programs based on respect for ethno-cultural diversity, open communication and effective interaction with local stakeholders that improve Education, health and infrastructure. These include:

### 1. Education:

- i. Post-secondary Education Scholarship Program for the Caylloma outstanding students. The scholarship is aimed to cover food, housing and student transport expenses.
- ii. Technical Productive Training Center in Caylloma to improve productivity of local trades. The company donated equipment and funded the operation of the center where approximately 40 students have received technical training in different industrial areas.

### 2. Health:

- i. "Essential Measures for Children" project which helped families with children under three years of age and pregnant women to overcome factors that influence and predispose children to chronic malnutrition and anemia. The project provided training in healthy eating habits and hygiene for schoolchildren in all schools in the district.
- ii. Inter-institutional Cooperation Agreement with the Regional Education Management and the Regional Health Management authorities to improve integral care services for the community. Two important programs were developed through this agreement:
  - a. Improvement of the health center's equipping to benefit women and children
  - b. The implementation of the "Healthy Schools and Family" program

### 3. Infrastructure:

- i. Construction and operation of a sanitary landfill for the town of Caylloma
- ii. Garbage compactor truck donation
- iii. Access and internal roads maintenance and improvements
- iv. Trout farming infrastructure donation and operation support
- v. Multipurpose complex for the town of Caylloma

In 2015 the company allocated US\$ 278,000 to fund existing and new community projects and budgeted a further US\$ 200,000 for 2016.

The increased employment that the mine brings to the area has resulted in the generation of secondary and tertiary employment through companies which provide different services to the operation. This has a significant positive economic impact in the area.

## 20.5 Mine closure

Mine closure is also included in the environmental program. For 2016 a total of US\$ 317,000 has been budgeted for the ongoing closure plan and environmental liabilities. The closure plan is performed to ensure compliance with the programs and plans submitted to the Ministry of Energy and Mining.

## 21 Capital and Operating Costs

Minera Bateas capital and operating cost estimates for Caylloma (summarized in Table 21.1 and Table 21.2) are based on 2015 costs. The analysis includes forward estimates for sustaining capital. Inflation is not included in the cost projections and exchange rates were estimated at S/3.30 (Peruvian Soles) to US\$1.

Capital costs include all investments in mine development, equipment and infrastructure necessary to upgrade the mine facilities and sustain the continuity of the operation.

**Table 21.1 Summary of projected major capital budget for 2016**

Capital Item	Cost (MUS\$)
<b>Mine Development</b>	
Development & Infrastructure	6.39
<b>Total Mine Development</b>	<b>6.39</b>
<b>Equipment and Infrastructure</b>	
Mine	0.64
Plant	0.98
Maintenance & Energy	0.85
IT	0.04
Logistics, Camp, Geology, Exploration, Planning	0.11
Laboratory	0.17
Environment	0.47
<b>Total Equipment and Infrastructure</b>	<b>3.00</b>
<b>Total Capital Expenditure</b>	<b>9.39</b>

**Table 21.2 Summary of projected major operating costs for 2016**

Operating Item	Cost US\$/t
<b>Cash cost</b>	
Mine ( <i>Mine Cash Cost per tonne was calculated using extracted ore</i> )	<b>40.17</b>
Plant	<b>12.48</b>
General Services	<b>9.07</b>
Administration	<b>5.75</b>
<b>Cash Cost</b>	<b>67.47</b>
<b>Mine Operating Expenses</b>	
Distribution	<b>11.54</b>
Management Fees	<b>0.21</b>
Community support activities	<b>0.41</b>
<b>Total Mine Operating Expenses</b>	<b>12.16</b>
<b>Total Cash Cost and Mine Operating Expenses</b>	<b>79.63</b>

### 21.1 Sustaining capital costs

A total of US\$9.39 million is budgeted for 2016 to sustain the operation. Capital costs are split into two areas, 1) mine development and 2) equipment and infrastructure.

### 21.1.1 Mine development and exploration

Mine development includes the main development and infrastructure of the mine through the generation of ramps, ore and waste shafts, ventilation shafts, and level extraction. The budget for these activities in 2016 is US\$ 6.39 million.

### 21.1.2 Equipment and infrastructure

Equipment and infrastructure costs are attributed to all departments of the mine including: mine, plant, tailing facilities, maintenance and energy, safety, information technology, administration and human resources, logistic, camps, geology, planning, laboratory and environmental. The budget for these areas is US\$ 3.00 million including US\$ 0.90 to complete the Processing Plant Optimization Project.

The capital cost budget in 2015 was US\$ 14.03 million with year-end capital costs totaling US\$ 9.93 million

## 21.2 Operating costs

Operating costs for 2016 include the cash costs (US\$ 67.47/t) and mine operating expenses (US\$ 12.16/t) for the operation (Table 21.2).

Cash costs relate to activities that are performed on the property including mine, plant, general services, and administrative service costs. Operating expenses include costs associated with distribution, general and administrative services, and community support activities.

### 21.2.1 Mine operating costs

Mining costs include drilling, blasting, support, loading and haulage. The 2016 budget for mining is US\$ 20.21 million which is based on the projected extraction of 503,100 t of ore and represents an equivalent unit cost of US\$ 40.17/t. The budget is based on the actual mine operating costs for 2015. The budgeted cost for 2015 was US\$ 43.57/t with the actual cost for the year being US\$ 43.60/t for the production of 450,319 t.

### 21.2.2 Plant operating costs

Plant costs are distributed over five areas: crushing, milling, flotation, thickening and filtering, and tailings disposal. The 2016 budget for plant operating costs is US\$ 6.28 million based on the projected treatment of 503,100 t representing an equivalent unit cost of US\$ 12.48/t. The budgeted cost for 2015 was US\$ 15.09/t with actual costs being US\$ 14.66/t. This unit cost was achieved through milling a total of 466,286t compare to the 464,100 t budgeted.

### 21.2.3 General services costs

General Service costs for 2016 are estimated to be US\$ 4.56 million based on 2015 figures. The general service costs cover operation's management, energy, maintenance, geology, planning, safety, environmental and laboratory costs. The budgeted cost for 2015 was US\$ 13.09/t with actual results for the year being US\$ 11.46/t.

### 21.2.4 Administrative mine costs

Administrative costs for 2016 are estimated to be US\$ 2.89 million based on the actual 2015 figures. Administrative service costs include administration, human resources, storage, hospital, legal, communication systems, accounting and cash, social assistance, community relations, camps, energy for the camp. Estimated costs for 2015 were US\$ 8.71/t with the actual costs for the year being US\$ 7.19/t.



### 21.2.5 Operating expenses

Operating expenses as opposed to mine operating expenses (general services and mine administration) are shared between distribution (transport and supervision of concentrate), management fees (and community support activities (support and projects with neighbor communities). Operating expenses for 2016 are estimated to be US\$ 6.12 million based on the actual 2015 figures.



## 22 Economic Analysis

The following section is a summary of the major economic consideration of the mine based on the economic analysis conducted by Fortuna following appropriate economic evaluation standards for an operating asset such as the Caylloma Mine.

The following section presents the elements of the financial model starting with the financial parameter assumptions and production estimates. Those main inputs allow the forecast of revenues, operating costs, capital costs, sustaining capital, working capital, closure and reclamation costs for final calculations of net project cash flows. The economic analysis has accounted for the increase in processing capacity of the plant from 1,300 tpd to 1,430 tpd in March 2016, and to 1,500 tpd from 2017, operating 357 days a year.

The start date for the economic analysis was January 1, 2016. The financial results are presented based on future metal production, operating costs (OPEX) and capital expenditures (CAPEX) to completion basis from this date. This represents the total project costs without the production and expenditures to that date. The economic analysis is based on an annual production plan for the life of the mine and associated operating and capital costs. The economic analysis calculates an after-tax NPV at a 5 percent discount rate of US\$ 51.6 million giving an average EBIDTA margin of 40.5 percent.

### 22.1 Financial assumptions

The most important financial assumptions influencing the economics of the mine include the following parameters:

- Silver price of US\$19 per ounce
- Gold price of US\$1,140 per ounce
- Lead price of US\$2,150 per tonne
- Zinc price of US\$2,300 per tonne
- Peruvian Nuevo Sole exchange rate (PEN S/3.30 = US\$1.00)
- Commercial royalty of 2 percent NSR for accumulated production in excess of 21 Moz Ag
- Income tax rate of 32 percent for 2016 and 2017, 27 percent for 2018 and 26 percent for 2019
- Mining tax of 1 percent for revenue under and 2 percent for revenue over US\$60 million
- Profit sharing rate of 8 percent based on taxable income

Exchange rate assumption are based on spot rates; no depreciation or appreciation is considered in the LOM. The exposure to local currency (40 percent) reflects the cost structure for the LOM.

### 22.1.1 Silver price

The base case financial model considers a silver price of US\$19 per troy ounce through 2019.

The price level used is within financial and mining analysts long-term forecast prices and forward selling curves. The average monthly silver price from August 2015 to July 2016 based on London Bullion Market Association (LBMA) pricing is shown in Figure 22.1.

**Figure 22.1 Average monthly silver price (US\$/troy ounce) from August 2015 to July 2016 based on LBMA pricing**

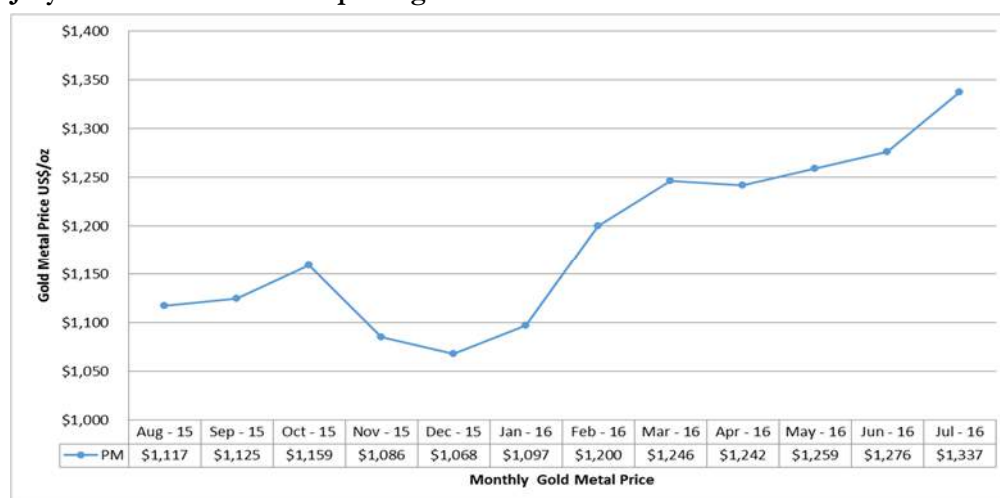


### 22.1.2 Gold price

The base case financial model considers a gold price of US\$1,140 per troy ounce through 2019.

The price level used is within long-term forecast prices and forward selling curves used by financial and mining analysts. The average monthly gold price from August 2015 to July 2016 based on LBMA post meridiem pricing is shown in Figure 22.2.

**Figure 22.2 Average monthly gold price (US\$/troy ounce) from August 2015 to July 2016 based on LBMA pricing**



### 22.1.3 Lead price

The base case financial model considers a lead price of US\$2,150 per tonne, through 2019. The price level used is within long-term forecast prices and forward selling curves used by financial and mining analysts.

### 22.1.4 Zinc price

The base case financial model considers a zinc price of US\$2,300 per tonne, through 2019. The price level used is within long-term forecast prices and forward selling curves used by financial and mining analysts.

### 22.1.5 Peruvian Nuevo Sol exchange rate

The main capital and operating costs denominated in Peruvian Nuevo Soles include:

- Wages and salaries
- Electrical power
- Contractor costs
- Services costs
- Material costs
- Federal, provincial and local taxes

Financial projections to assess economics for the Caylloma Mine have used an exchange rate of S/3.30 to US\$1.00 in line with current exchange rates.

## 22.2 Life-of-mine production plan

The life-of-mine (LOM) plan includes the estimated Mineral Reserves (1.98 Mt) reported as of December 31, 2015 as well as stockpiled ore as of December 2015 (0.02 Mt). The Mineral Reserve estimate has only considered Measured and Indicated Resources (4.11 Mt) and does not include any Inferred Resources. Table 22.1 details the annual production plant feed and concentrate production for the Caylloma Mine.

**Table 22.1 Life-of-mine production plan for the Caylloma Mine**

Type	Item	2016	2017	2018	2019*	Total
<b>Treatment</b>	dmt	503,100	510,510	510,510	478,175	<b>2,002,295</b>
	Ag (g/t)	87	88	188	125	<b>122</b>
	Au (g/t)	0.24	0.20	0.38	0.40	<b>0.30</b>
	Pb (%)	3.36	3.32	2.48	2.06	<b>2.82</b>
	Zn (%)	3.90	4.15	2.93	3.17	<b>3.54</b>
<b>Metallurgical Recovery</b>	Ag (%)	82	84	87	85	<b>84</b>
	Au (%)	28	18	25	25	<b>24</b>
	Pb (%)	94	94	92	92	<b>93</b>
	Zn (%)	90	89	88	88	<b>89</b>
<b>Concentrate</b>	Pb (dmt)	29,422	28,277	22,845	18,068	<b>98,611</b>
	Zn (dmt)	35,337	37,715	26,308	26,695	<b>126,056</b>
<b>Metal Content</b>	Ag (oz)	1,147,837	1,218,394	2,684,644	1,631,621	<b>6,682,497</b>
	Au (oz)	1,072	589	1,563	1,528	<b>4,753</b>
	Pb (tms)	15,888	15,835	11,651	9,034	<b>52,408</b>
	Zn (tms)	17,669	18,857	13,154	13,348	<b>63,028</b>

(\*) Includes 23,972 tms from stockpiles (100 g/t Ag, 0.17 g/t Au, 2.03 % Pb y 2.32 % Zn) as per Dec 2015

#### *inventory*

The LOM annual tonnage and head grades have been obtained from the Mineral Reserves estimate based on the processing plant treatment capacity and the established mining sequence for reserves in the mineral deposit.

Metallurgical recoveries, concentrate production and metal content for the LOM have been estimated based on the estimated head grades, processing plant historical metallurgical recoveries as well as metallurgical testing (as described in Sections 13 and 15).

## 22.3 Operating costs

The projected operating costs are based on the related LOM mining and processing requirements, as well as historical information regarding performance and operation and administrative support demand. Table 22.2 details the projected operating costs for the life-of-mine.

**Table 22.2 Life-of-mine operating costs (OPEX)**

Area	Units	2016	2017	2018	2019
Mine	US\$ '000	20,210	18,612	16,591	13,946
Plant	US\$ '000	6,281	6,826	6,826	6,394
Mine General Services	US\$ '000	4,564	5,069	5,069	4,748
Mine Administrative Services	US\$ '000	2,891	2,907	2,907	2,723
Mine Operating Expenses	US\$ '000	6,115	5,389	5,389	5,054
<b>Total</b>	<b>US \$ '000</b>	<b>40,062</b>	<b>38,803</b>	<b>36,782</b>	<b>32,865</b>

## 22.4 Capital costs

The projected capital costs (Table 22.3) are based on the related LOM mine development, equipment and infrastructure requirements. Capital costs related to the mine closure increase the equipment and infrastructure expenses in the final year of the LOM (2019).

Fortuna has operated the Caylloma Mine since 2006 so the capital costs in this case are referring to the annual addition of capital required to sustain the operation and production at current levels (i.e. sustaining capital expenditure).

**Table 22.3 Life-of-mine capital costs (CAPEX)**

Description	Units	2016	2017	2018	2019	Total
Mine Development	US\$ '000	6,389	3,552	4,733	3,863	18,537
Equipment and Infrastructure	US\$ '000	3,002	7,858	4,293	13,087	28,240
<b>Total</b>	<b>US\$ '000</b>	<b>9,391</b>	<b>11,410</b>	<b>9,026</b>	<b>16,950</b>	<b>46,777</b>

## 22.5 Economic analysis summary

The summary of the LOM economic analysis, showing the annual free cash flow forecast based on the Proven and Probable Reserves, is shown in Table 22.4.

The economic evaluation shows positive after tax free cash flow for the LOM, consequently it also shows a positive Net Present Value (NPV). The NPV at a 5 percent discount rate is US\$52.2 million. The Internal Rate of Return (IRR) and payback period do not apply for a presently operating mine with a LOM positive cash flow.

**Table 22.4 Financial Summary**

Description	Units	2016	2017	2018	2019
Revenues	US\$ '000	69,567	72,516	81,726	60,780
Net Income	US\$ '000	8,360	8,128	12,789	-13,590
EBITDA	US\$ '000	25,009	28,605	38,762	23,901
EBITDA Margin	%	36	39	47	39
Investments	US\$ '000	9,391	11,410	9,026	16,950
<b>Free cash flow</b>	<b>US\$ '000</b>	<b>11,015</b>	<b>14,259</b>	<b>25,029</b>	<b>8,717</b>
<b>NPV @ 5 %</b>		<b>52,217</b>			

## 22.6 Sensitivity analysis

Sensitivity analyses has been performed to assess the effect on the NPV of changing silver, lead, and zinc metal prices, as well as the effects of altering head grade, capital and operating costs.

### 22.6.1 Sensitivity to metal price

The effect of changing silver prices by US\$1/oz increments and base metal prices by a 10 percent positive and negative increment from the base case is detailed in Table 22.5. The effect of varying the lead and zinc metal prices (by US\$100/t increments) is detailed in Table 22.6.

**Table 22.5 Sensitivity analysis on varying silver and base metal prices on NPV**

NPV Sensitivity		Silver price (\$ / oz)				
		17	18	19	20	21
Change in base metal prices	-10 %	38,269	41,782	45,288	48,788	52,288
	0 %	45,217	48,717	52,217	55,717	59,217
	+10 %	51,452	54,952	58,452	61,952	65,437

**Table 22.6 Sensitivity analysis for lead and zinc metal price variations on NPV**

NPV Sensitivity		Lead (US\$/t)				
		1,950	2,050	2,150	2,250	2,350
Zinc (US\$ / t)	2,100	45,997	49,455	49,596	51,095	52,593
	2,200	47,307	50,766	50,907	52,405	53,903
	2,300	48,617	52,076	52,217	53,715	55,213
	2,400	49,928	53,386	53,527	55,025	56,524
	2,500	51,238	54,697	54,838	56,336	57,834

### 22.6.2 Sensitivity to head grades

The effect on NPV when varying the silver or base metal head grades as expressed at a 10 percent negative and positive increment from the base case is detailed in Table 22.7.

**Table 22.7 Sensitivity analysis for silver and base metal head grade variations on NPV**

NPV Sensitivity		Change in Silver Head Grade		
		-10 %	0 %	+10 %
Change in base metal head grades	-10 %	38,740	45,366	51,972
	0 %	45,611	52,217	58,823
	+10 %	52,434	59,041	65,633

### 22.6.3 Sensitivity to capital and operating costs

The effect on NPV when varying the capital and operating costs as expressed at a 10 percent negative and positive increment from the base case is detailed in Table 22.8.

**Table 22.8 Sensitivity analysis for capital and operating cost variations on NPV**

NPV Sensitivity		Change in capital costs		
		-10 %	0 %	+10 %
Change in operating costs	-10 %	66,001	61,898	57,794
	0 %	56,320	52,217	48,114
	+10 %	46,640	42,536	38,433

The conclusion of the sensitivity analysis is that NPV at the Caylloma Mine is most sensitive to changes in metal prices and operating costs.

## 22.7 Taxes

Peruvian tax laws make allowance for 10-year and 15-year tax stability contracts. In the case of Caylloma, a 10-year stability contract was signed in 2007, came into effect in 2008 and expires in 2017. During the period covered by the stability contract, the income tax rate is 32 percent. Once the stability contract expires, income tax rates under the Peruvian general tax regime will apply; the rates established under this regime are 27 percent for 2018 and 26 percent for 2019. Profit sharing rate is 8 percent. Profit sharing schemes for companies in the mining industry, among other industries, are mandatory according to law. The rate is applied to profit before income taxes.



## 23 Adjacent Properties

There is no information regarding adjacent properties applicable to the Caylloma Property for disclosure in this report.

## 24 Other Relevant Data and Information

Fortuna considers that the Technical Report contains all the relevant information necessary to ensure the report is understandable and not misleading.



## 25 Interpretation and Conclusions

Minera Bateas continues to successfully manage the Caylloma operation, processing 466,286 t of ore in 2015 from its underground mining operations. That same year Caylloma produced 1.7 Moz of silver while investing heavily in the plant optimization, maintenance and energy.

Fortuna believes there is good potential for a significant increase of the Mineral Resources at the Caylloma Property particularly from the continuity of the current veins in operation as well as from the discovery of new veins. Exploration development and investigation will continue through 2016 with \$2.9 million assigned to the 2016 Brownfields exploration budget.

Proven and Probable Mineral Reserves total 1.98 Mt at an average grade of 121 g/t Ag, 0.30 g/t Au, 2.83 % Pb, and 3.55 % Zn as of December 31, 2015. The conversion of Mineral Resources to Mineral Reserves considered different NSR cut-off values for each vein in accordance with the operation costs, metal prices and plant performance data.

Minera Bateas continues to investigate cost effective ways to improve productivity and reduce costs. Projects completed in 2016 include the optimization of the plant including an expansion of the lead flotation capacity to increase silver metallurgical recoveries by between 2 and 4 percent and increase overall plant throughput by 10 percent. Minera Bateas has also launched a maintenance and energy project to reduce ongoing power costs which includes a new higher capacity electric transformer installation as well as a new transmission line from Caylloma substation to the mine.

The mining operation has been developed under strict compliance of norms and permits required by public institutions associated with the mining sector. Furthermore, all work follows quality and safety international norms as set out in ISO 14001 and OHSAS 18000.

Minera Bateas continues assisting with the development of sustainable programs to benefit the local communities including educational, nutritional and economical programs. The socio–environmental responsibilities of these programs ensure a good relationship between the company and local communities. This will help the growth and continuity of the mining operation while local communities improve their economies and living standards.

Operating costs are reasonable for production rates in a mine of this size and are comparable to other mines in the area with similar characteristics.

Sustaining capital costs are regarded as reasonable in order to improve plant optimization, maintenance, energy and ensure continuity and sustainability of the mining operation.

## 26 Recommendations

Recommended work programs being conducted in 2016 to improve the operation include the following:

1. **Brownfields exploration.** Fortuna has assigned US\$2.9 million in 2016 for Brownfields exploration of the Caylloma District. This includes 17,000 meters of diamond drilling focused on testing new exploration targets in the northern portion of Pisacca prospect area located a short distance to the southwest of the mine plant as well as further exploring the northeastern extension of the Animas vein.
2. **Underground development.** The most important recommended project for the Caylloma Mine is the integration of the different levels of the Animas vein with underground ramps. An important effort in 2012 was made to improve ventilation which has allowed the operation to introduce the use of ANFO for stoping and drifting. The mine plan for 2016 includes 1,053 m of raise boring in order to comply with the ventilation requirements, 1,904 m horizontal, and 5,158 m decline drift associated with the development of the mine especially in the case of the Animas vein. The budgeted cost of this work program in 2016 is US\$9.29 million.
3. **Metallurgical studies to improve silver recovery.** Important efforts were made in 2015 in order to optimize the metallurgical performance and throughput capacity of the plant, especially to increase silver recovery. It is recommended that an expansion to the lead flotation capacity be considered with the objective of increasing silver recovery by 2 to 4 percent. The budgeted cost for these metallurgical studies in 2016 is US\$1 million.
4. **Metallurgical studies to improve oxide recovery.** The response of “oxide” material to the flotation process requires additional testwork. The plant test conducted in 2012 demonstrated this material could be processed through flotation albeit at reduced recoveries. Results can help to adjust plant operating parameters to improve metallurgical response.
5. **Metallurgical studies in gold recovery.** Mineral Bateas applies a higher gold metallurgical recovery for the calculation of the NSR values for the estimate of blocks in the Ramal Piso Carolina vein based on metallurgical testwork conducted in the plant. There are however, other veins that have elevated gold grades that could benefit from the application of a higher metallurgical gold recovery including the San Carlos, San Pedro, Don Luis II, La Plata, and Cimoide La Plata veins. It is recommended that Minera Bateas conduct metallurgical testwork on mineralized samples from these veins to ascertain if the gold recoveries can be improved.

In addition to the confirmed projects for 2016 the following work is recommended:

- Increase the number of bulk density measurements in veins that lack sufficient values for a meaningful statistical analysis. In addition to this it is also recommended that a study be performed to improve the understanding of the bulk density in the deposit. If a correlation between density and mineralogy could be established it may provide a superior alternative than the presently used global density assignment.

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## Certificates

### **CERTIFICATE of QUALIFIED PERSON**

(a) I, Eric N. Chapman, Corporate Head of Technical Services for Fortuna Silver Mines Inc., 650-200 Burrard St, Vancouver, BC, V6C 3L6 Canada; do hereby certify that:

(b) I am the co-author of the amended technical report titled Fortuna Silver Mines Inc. Caylloma Property, Caylloma District, Peru dated effective August 31, 2016 (the "Technical Report").

(c) I graduated with a Bachelor of Science (Honours) Degree in Geology from the University of Southampton (UK) in 1996 and a Master of Science (Distinction) Degree in Mining Geology from the Camborne School of Mines (UK) in 2003. I am a Professional Geologist of the Association of Professional Engineers and Geoscientists of the Province of British Columbia (Registration No. 36328) and a Chartered Geologist of the Geological Society of London (Membership No. 1007330). I have been preparing resource estimates for approximately thirteen years and have completed more than twenty resource estimates for a variety of deposit types such as epithermal gold/silver veins, porphyry gold deposits, banded iron formations and volcanogenic massive sulfide deposits. I have completed at least eight Mineral Resource estimates for polymetallic projects over the past seven years.

I have read the definition of 'qualified person' set out in National Instrument 43-101 ("the Instrument") and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfill the requirements of a 'qualified person' for the purposes of the Instrument.

(d) I last visited the property from May 31 to June 2, 2016;

(e) I am responsible for the preparation of sections 1: Summary; 2: Introduction; 3: Reliance on other experts; 4: Property description and location; 5: Accessibility, climate, local resources, infrastructure and physiography; 6: History; 7: Geological setting and mineralization; 8: Deposit types; 9: Exploration; 10: Drilling; 11: Sample preparation, analyses and security; 12: Data verification; 14: Mineral Resource estimates; 23: Adjacent properties; 25: Interpretation and conclusions; 26: Recommendations; 27: References of the Technical Report.

(f) I am an employee of the issuer, Fortuna Silver Mines Inc.

(g) I have been an employee of Fortuna and involved with the property that is the subject of the Technical Report since May 2011.

(h) I have read the Instrument and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.

(i) As of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated at Vancouver, BC, this 30th day of January 2017.

[signed]

Eric N. Chapman, P. Geo., C. Geol. (FGS)

**CERTIFICATE of QUALIFIED PERSON**

(a) I, Edwin Gutierrez, Technical Services Manager of Fortuna Silver Mines Inc., Piso 5, Av. Jorge Chavez # 154, Miraflores, Lima, Peru; do hereby certify that:

(b) I am the co-author of the amended technical report titled Fortuna Silver Mines Inc. Caylloma Property, Caylloma District, Peru dated effective August 31, 2016 (the "Technical Report").

(c) I graduated with a Bachelor of Science Degree in Mining from Pontificia Universidad Catolica del Peru, Lima, Peru in 2000. I have a Master of Science Degree in Mining from University of Arizona, USA, granted in 2008. I am a Registered Member of the Society for Mining, Metallurgy and Exploration, Inc. (SME Registered Member Number 4119110RM). I have practiced my profession for 16 years. I have been directly involved in underground and open pit operations, mining consulting, and assisting in the development of mining projects in Perú, Brazil, Chile, Argentina, Ghana, Democratic Republic of Congo, Indonesia, Canada, United States and Mexico.

I have read the definition of 'qualified person' set out in National Instrument 43-101 ("the Instrument") and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfill the requirements of a 'qualified person' for the purposes of the Instrument.

(d) I last visited the property in July 2016;

(e) I am responsible for the preparation of sections 1: Summary; 2: Introduction; 13: Mineral processing and metallurgical testing; 15: Mineral Reserve estimate; 16: Mining Methods; 17: Recovery methods; 18: Project Infrastructure; 19: Market studies and contracts; 20: Environmental studies, permitting and social or community impact; 21: Capital and operating costs; 22: Economic analysis; 24: Other relevant information; 25: Interpretation and conclusions; 26: Recommendations; 27: References of the Technical Report.

(f) I am an employee of the issuer, Fortuna Silver Mines Inc.

(g) I have been an employee of Fortuna and involved with the property that is the subject of the Technical Report since July 2015.

(h) I have read the Instrument and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.

(i) As of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated at Lima, Peru, this 30th day of January 2017.

[signed]

Edwin Gutierrez, SME Registered Member