PAN AMERICAN SILVER CORP
Form 6-K
February 05, 2010

SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM 6-K

Report of Foreign Private Issuer
Pursuant to Rule 13a-16 or 15d-16 of
the Securities Exchange Act of 1934

For the month of, February 2010
Commission File Number000-13727

Pan American Silver Corp
(Translation of registrant's name into English)

1500-625 Howe Street, Vancouver BC Canada V6C 2T6
(Address of principal executive offices)

Indicate by check mark whether the registrant files or will file annual reports under cover of Form 20-F or Form 40F:

Form 20-F		Form 40-F	X

Indicate by check mark if the registrant is submitting the Form 6-K in paper as permitted by Regulation S-T Rule 101(b)(1):

Indicate by check mark if the registrant is submitting the Form 6-K in paper as permitted by Regulation S-T Rule 101(b)(7):

Indicate by check mark whether by furnishing the information contained in this Form, the registrant is also thereby furnishing the information to the Commission pursuant to Rule 12g3-2(b) under the Securities Exchange Act of 1934.

Yes		No	X

If "Yes" is marked, indicate below the file number assigned to the registrant in connection with Rule 12g3-2(b): 82-_______________

DOCUMENTS INCLUDED AS PART OF THIS REPORT

Document

1 Technical report entitled "Pan American Silver Corp: Navidad Project, Chubut Province, Argentina", dated February 4, 2010.

Document 1

Pan American Silver Corp: Navidad Project, Chubut Province, Argentina

February 2010

Prepared by

Pamela De Mark
B.Sc. (App.Geo) Hons, P. Geo., MAusIMM
Senior Consultant, Snowden Mining Industry Consultants

John J. Chulick
B.Sc. (Geo. Eng.) Hons, MBA, SEG, Licensed Professional Geologist
Vice President Exploration, Aquiline Resources Inc.

Dean K. Williams
B.Sc. (Geo.) Hons, MBA, SEG, Licensed Professional Geologist
Chief Geologist, Aquiline Resources Inc.

Damian Spring
B.E. (Mining), MAusIMM
Chief Mining Engineer, Aquiline Resources Inc.

John A. Wells
B.Sc. Hons, MBA, MCIMM, FSAIMM
Independent Metallurgical Consultant

Office Locations

Perth
87 Colin Street
West Perth WA 6005

PO Box 77
West Perth WA 6872
AUSTRALIA

Tel: +61 8 9213 9213
Fax: +61 8 9322 2576
ABN 99 085 319 562
perth@snowdengroup.com

Brisbane
Level 15, 300 Adelaide Street
Brisbane QLD 4000

PO Box 2207
Brisbane QLD 4001
AUSTRALIA

Tel: +61 7 3231 3800
Fax: +61 7 3211 9815
ABN 99 085 319 562
brisbane@snowdengroup.com

Vancouver
Suite 600
1090 West Pender Street
Vancouver BC V6E 2N7
CANADA

Tel: +1 604 683 7645
Fax: +1 604 683 7929
Reg No. 557150
vancouver@snowdengroup.com

Johannesburg
Technology House
Greenacres Office Park
Cnr. Victory and Rustenburg Roads
Victory Park
Johannesburg 2195
SOUTH AFRICA

IMPORTANT NOTICE

This report was prepared as a National Instrument 43-101 Technical Report, in accordance with Form 43-101F1, for Pan American Silver Corp. by Snowden. The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in Snowden's services, based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This report is intended to be used by Pan American Silver Corp., subject to the terms and conditions of its contract with Snowden. That contract permits Pan American Silver Corp. to file this report as a Technical Report with Canadian Securities Regulatory Authorities pursuant to provincial securities legislation. Except for the purposes legislated under provincial securities law, any other use of this report by any third party is at that party's sole risk.
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PO Box 2613
Parklands 2121
SOUTH AFRICA

Tel: + 27 11 782 2379
Fax: + 27 11 782 2396
Reg No. 1998/023556/07
johannesburg@snowdengroup.com

London
Abbey House
Wellington Way
Weybridge
Surrey KT13 0TT, UK

Tel: + 44 (0) 1932 268 701
Fax: + 44 (0) 1932 268 702
london@snowdengroup.com

Website
www.snowdengroup.com

Subsidiary of Downer EDI Ltd

Pan American Silver Corp:

Pan American Silver Corp:

Pan American Silver Corp:

Pan American Silver Corp:

Tables

Pan American Silver Corp:

Figures

Appendices

Pan American Silver Corp:

1 Summary

This Technical Report refers to the Navidad Project, an advanced stage silver-lead mineral exploration project located in Chubut Province, Argentina, owned by Pan American Silver Corp. (Pan American) through its subsidiary Aquiline Resources Inc. (Aquiline), who in turn conduct business in Argentina through its subsidiaries Minera Aquiline Argentina S.A. (Minera Aquiline), and Minera Argenta S. A.. Pan American is a silver mining company based in Canada and listed on the Toronto Stock Exchange (TSX:PAA) and on NASDAQ (PAAS).

The Supreme Court of British Columbia awarded ownership of the Navidad Project to Minera Aquiline on 14 July 2006 following a court case with IMA Exploration Inc. (IMA) where IMA was found to have breached a Confidentiality Agreement with Minera Normandy Argentina S.A. (Minera Normandy), then a subsidiary of Newmont Mining Corporation. Minera Normandy was subsequently acquired by Aquiline and its name was changed to Minera Aquiline. IMA appealed the trial court decision to the Appeal Court of British Columbia which denied the appeal in reasons for judgment dated 7 June 2007. In September 2007 IMA submitted an Application for Leave to Appeal to the Supreme Court of Canada. Sole ownership rights were granted to Aquiline by the Supreme Court of Canada on 20 December 2007, subject to Aquiline making payment to IMA which would reimburse the latter for its accrued exploration expenditures up to the July 2006 court decision. Aquiline's final payment to IMA was made on 8 February 2008 giving Aquiline full ownership of the Project.

On 14 October 2009, Pan American announced a friendly offer to acquire all of the issued and outstanding securities of Aquiline. On 7 December 2009, Pan American acquired approximately 85% of the issued and outstanding shares of Aquiline and extended its bid to 22 December 2009, and on that latter date, Pan American took up an additional approximately 7% of the issued and outstanding shares in the capital of Aquiline. Since the offer to acquire the Aquiline shares was accepted by holders of more than 90% of the Aquiline shares, on 23 December 2009, Pan American provided notice to the remaining shareholders of its intention to exercise its right to acquire the remaining issued and outstanding Aquiline shares pursuant to the compulsory acquisition provisions of the Business Corporation Act (Ontario). Pan American was deemed to have acquired the balance of the Aquiline shares not already owned by it pursuant to the compulsory acquisition on or about 22 January 2010.

As a result of its acquisition of Aquiline, Pan American is required to file a technical report on the Navidad Project pursuant to NI 43-101. This Technical Report is prepared to fulfil this requirement and is based on information disclosed in the Technical Report filed on SEDAR by Aquiline on 2 June 2009, and dated May 2009, amended June 2009 (Snowden, 2009). There are no other material changes to the Navidad Project to report aside from the acquisition of Aquiline by Pan American.

The June 2009 Technical Report (Snowden, 2009) disclosed recently updated Mineral Resources at the Calcite NW, Calcite Hill, Navidad Hill, Connector Zone, Galena Hill, Barite Hill, and Loma de La Plata, and disclosed the first Mineral Resource for Valle Esperanza at the Navidad Project. The amended report dated June 2009 included the assay results of independent samples selected by Snowden in April 2009, which were not available at the time of the original filing on SEDAR in May, 2009.

Mineral Resource estimates were reported at the Navidad Property (Table 1.1) effective April 2009. Tonnes and grades were reported above a cut-off grade of 50 g/t silver equivalent. To date, no analysis has been made to determine the economic cut-off grade that will ultimately be applied to the whole Navidad Project. Silver equivalence was calculated using three year rolling average prices for silver ($12.52 per oz) and an approximate ten year rolling average price for lead ($0.50 per lb). The following formula, which does not include any other factors such as variable metal recoveries, was applied to reach the silver equivalent value: $AgEQ(g/t) = Ag(g/t) + (Pb(\%) \times 10{,}000/365)$.

The deposit areas at Navidad occur within a sedimentary package known as the Cañadón Asfalto Formation hosting an intermediate volcanic rock identified as trachyandesite, referred to locally as latite. Lithologies described as the Cañadón Asfalto may occur both above and below intercalated bodies of latite. The entire sequence is interpreted to have been deposited within a lacustrine basin environment.

A group of eight individual deposits and six prospects have been identified at the project and seven of these have been the subject of previous Mineral Resource estimates (Snowden 2006a, Snowden 2006b, and Snowden, 2007). All of these deposits are either hosted in the latite unit itself or in the sedimentary sequence proximal to the latite. Base metals, principally lead and to a lesser extent copper, are typically present but are largely not significant in quantity except at Galena Hill. There has been virtually no gold detected to date.

Since the filing of the November 2007 Technical Report, additional geochemical and geophysical surveys plus 367 diamond drillholes totalling 92,540 m have been done on the Project. The geophysical surveys over the core area of the property have included gravity, deep-array pole-dipole IP, CSAMT, and a high definition ground magnetometer survey. At Navidad only the latter technique has shown some continued promise as an exploration guide through the interpretation of the detailed structural setting in the district.

The drilling programme continued to yield significant results during the past 18 months, and of particular significance is the discovery of the Valle Esperanza deposit which in this estimate contains in the Indicated category 12.2 Mt at a grade of 172 g/t Ag, above a cut-off grade of 50 g/t AgEQ. In the Inferred category, the deposit contains 10.8 Mt at a grade of 123 g/t Ag above the same cut-off grade. The grade, geometry, and depth of this deposit are such that underground mining is a potential option.

Early metallurgical testing of Galena Hill has proved that differential flotation was effective in producing a lead concentrate and silver-rich concentrate, although it was recommended significant work was required to increase overall silver recovery and improve the quality of the concentrate for sale. Subsequent analysis of the pyrite concentrate mineralogy (XPS, 2007) identified the potential to upgrade the concentrate by inserting cleaning and entrainment controls into the circuit such as froth washing and column flotation, that improve concentrate grades by a factor of 2.5.

Initial metallurgical testing of Loma de La Plata proved highly successful especially as recovery of silver exceeded 80% and the concentrate was high in silver (around 50 kg/t Ag), but low in lead with a combined base metal (copper plus lead) content of 15% to 25%. Subsequent efforts were directed at testing the variability of the deposit in support of a Preliminary Economic Assessment of Loma de La Plata only. The test work at both G&T and XPS concluded that Loma de La Plata ore responds well to flotation, with high recoveries and concentrate grades. A simple crushing, grinding, and single product flotation concentrator was proposed for the PEA, and the concentrate sold to an offshore copper smelter with minor penalties for lead.

With the discovery of Valle Esperanza and its similarity in mineralisation style to Loma de La Plata, metallurgical testing was expanded to incorporate deposits likely to produce a high-value silver concentrate with low lead content. Testing of Valle Esperanza and Barite Hill samples yielded satisfactory results, and as with Loma de La Plata, silver recoveries of 80% or better appear likely. The concentrate grades from Valle Esperanza are particularly high (over 50 kg/t Ag to 60 kg/t Ag), while those from Barite Hill are also satisfactory containing 20 kg/t Ag to 25 kg/t Ag. However, the individual concentrates contain high levels of penalty elements such as arsenic and antimony. Mr. Wells believes that Loma de La Plata, Barite Hill, and Valle Esperanza can all be treated in the same, simple, one-product concentrator.

The testing of Loma de La Plata is likely to be sufficient to support a Feasibility Study. A large quantity of core has been kept in sealed bags and is sufficient for a pilot plant test should this be considered necessary.

The Preliminary Economic Assessment of Loma de La Plata (Snowden, 2008), concluded the development of Loma de La Plata would deliver a pre-tax NPV at 7.5% of US$135.6 million, and internal rate of return (IRR) of 22%, and a 25 month payback period.

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Table 1.1 Navidad April 2009 Mineral Resources reported above a cut-off grade of 50 g/t AgEQ

Deposit	Classification	Tonnes (Mt)	AgEQ g/t	Ag g/t	Pb%	Cu%	Contained Ag (Moz)	Contained Pb (Mlb)	Contained Cu (Mlb)
Calcite Hill NW	Measured	-	-	-	-	-	-	-	-
	Indicated	14.8	94	78	0.59	-	37	194	-
	Meas. + Ind.	14.8	94	78	0.59	-	37	194	-
	Inferred	14.6	74	52	0.82	-	24	265	-
Calcite Hill	Measured	-	-	-	-	-	-	-	-
	Indicated	17.5	115	100	0.55	-	56	212	-
	Meas. + Ind.	17.5	115	100	0.55	-	56	212	-
	Inferred	4.9	106	96	0.36	-	15	39	-
Navidad Hill	Measured	8.4	122	109	0.46	-	29	85	-
	Indicated	5.6	96	90	0.24	-	16	29	-
	Meas. + Ind.	14	112	101	0.37	-	45	114	-
	Inferred	1.8	81	70	0.41	-	4	16	-
Connector Zone	Measured	-	-	-	-	-	-	-	-
	Indicated	8.2	102	91	0.41	-	24	74	-
	Meas. + Ind.	8.2	102	91	0.41	-	24	74	-
	Inferred	9.9	88	74	0.49	-	24	107	-
Galena Hill	Measured	7	242	170	2.62	-	38	404	-
	Indicated	44.7	166	117	1.78	-	168	1,754	-
	Meas. + Ind.	51.7	176	124	1.89	-	206	2,158	-
	Inferred	1.7	116	80	1.35	-	4	50	-

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Deposit	Classification	Tonnes (Mt)	AgEQ g/t	Ag g/t	Pb%	Cu%	Contained Ag (Moz)	Contained Pb (Mlb)	Contained Cu (Mlb)
Barite Hill	Measured	-	-	-	-	-	-	-	-
	Indicated	7.7	161	153	0.28	-	38	48	-
	Meas. + Ind.	7.7	161	153	0.28	-	38	48	-
	Inferred	0.9	100	81	0.69	-	2	13	-
Loma de La Plata	Measured	-	-	-	-	-	-	-	-
	Indicated	29.1	172	169	0.09	0.05	158	58	33
	Meas. + Ind.	29.1	172	169	0.09	0.05	158	58	33
	Inferred	1.3	82	76	0.21	0.05	3	6	1
Valle Esperanza	Measured	-	-	-	-	-	-	-	-
	Indicated	12.2	178	172	0.21	-	68	56	-
	Meas. + Ind.	12.2	178	172	0.21	-	68	56	-
	Inferred	10.8	133	123	0.35	-	43	84	-
Total	Measured	15.4	177	137	1.44	0	67	489	0
	Indicated	139.8	147	126	0.79	0.05	565	2,425	33
	Meas. + Ind.	155.2	150	127	0.85	0.05	632	2,914	33
	Inferred	45.9	97	81	0.57	0.05	119	580	1

Notes:
The most likely cut-off grade for these deposits is not known at this time and must be confirmed by the appropriate economic studies.
Silver equivalent grade values are calculated without consideration of variable metal recoveries for silver and lead. A silver price of US$12.52/oz and lead price of US$0.50/lb was used to derive an equivalence formula of AgEQ g/t = Ag g/t + (Pb% × 10,000 / 365). Silver prices are based on a three-year rolling average and lead prices are based on an approximate ten-year rolling average.
The estimated metal content does not include any consideration of mining, mineral processing, or metallurgical recoveries.
Tonnes, ounces, and pounds have been rounded and this may have resulted in minor discrepancies in the totals.
Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. No Mineral Reserves have been estimated.

The estimate of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant issues.

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Measured and Indicated Mineral Resources silver ounces have increased by 40% since the November 2007 Mineral Resource estimate. This increase is mainly contributed by the upgrade of Inferred resources to Indicated resources, defined during infill drilling at Loma de La Plata. Valle Esperanza is now estimated to contain the largest Inferred resource of the Project. With additional infill drilling on 50 m sections at Valle Esperanza, the conversion rate of Inferred resources to Indicated resources is anticipated to be as high as that experienced at the other deposits at the Project.

No Mineral Reserves have been estimated at this time. Additional studies will be required to determine technical, economic, legal, environmental, socio-economic, and governmental factors. These modifying factors are normally included in a mining feasibility study and are a pre-requisite for conversion of Mineral Resources to, and reporting of, Mineral Reserves. The CIM Standards (CIM, 2005) describe completion of a Preliminary Feasibility Study as the minimum prerequisite for the conversion of Mineral Resources to Mineral Reserves.

The following recommendations are made for the further advancement of the Project:

- Continue metallurgical definition of the deposits with particular emphasis on Galena Hill, which hosts 30% of the Indicated Resource silver ounces as well as 2,158 Mlb of lead in the Measured and Indicated categories.

- Using the Loma de La Plata Preliminary Economic Assessment study as a model, develop an expanded model to include Valle Esperanza and Barite Hill as sources of high-grade silver concentrates with relatively low base metal content.

- Develop a global Preliminary Economic Assessment that takes all deposits into consideration with emphasis on an optimum extended mine life.

- Continue selective exploration of the best targets in the core project area that have Loma de La Plata or Valle Esperanza type potential. The continued exploration in the extended Valle Esperanza Valley is one of the highest priority areas.

- Continue to evaluate and prioritise the various mining concessions that Pan American controls along the Gastre Fault structural trend.

- Continue to advance the Navidad environmental base line studies in anticipation of an eventual filing of the appropriate environmental impact statement (EIS). In the short term Pan American plans to engage an international-level consultant to conduct a baseline review and plan the outstanding baseline work to complete the environmental impact assessment (EIA) for the proposed mine. This consultant would conduct an independent evaluation and consult with the Chubut Provincial authorities. The consultant would then assist with baseline studies and ultimately be responsible for preparation of the mine EIA.

- Pan American should continue and increase efforts to explain and present the Navidad Project to the authorities in the Chubut Provincial government, especially stressing the benefits in employment, infrastructure, and tax revenue that would accrue to the community if the authorities were to rescind legislation that currently prohibits open pit mining.

Pan American should continue to implement their proposed continuous improvement practices on diamond drilling, QAQC, sampling, density determinations, and resource modelling aspects at the Project, including:

- Survey all drillholes regardless of their orientation, with the first measurement taken at the collar of the drillhole, to ensure that the spatial location of mineralisation is well defined.

- Continue to refine the effectiveness of the QAQC database through more accurate documentation of the QAQC sample type and the analytical method, and by following the recommendations made by Smee (2008); these recommendations are being implemented.

- Determine the density of drill core prior to splitting with a diamond saw to reduce the error in the calculation introduced by a small sample size. Samples should be coated with a material such as wax or varnish to prevent water retention in the sample from influencing the calculated specific gravity value. Samples should be selected according to a representative suite of lithologies, mineralisation, and alteration types, through spatially representative locations throughout the area covered by drilling. The representativity can be confirmed by consulting the number of density determinations tabulated by grade estimation domain for each deposit in Table 17.10, and increasing the number of density samples in domains with low sample numbers relative to the number of sample assays in the domain. Spatial representativity can be confirmed by plotting the location of specific gravity samples on the drillhole trace in plan and in section.

- Further refine the geological interpretation to incorporate all available geological information, including surface mapping (including the position of outcropping mineralisation), geophysical information, structural information, and core logging detail in digital, three dimensional format.

- Continue the modelling of fault interpretations for use in future resource estimations.

- Undertake a study of the differences between the oxide and sulphide zones for modelling in future resource estimations.

Snowden further recommends that Pan American undertake a drillhole spacing study at Loma de La Plata using conditional simulation to quantify the optimal drillhole spacing required to achieve a range of estimation qualities. Some close-spaced drilling should be performed in a representative mineralised domain to characterise the short-range behaviour of the mineralisation. Aquiline has already drilled 23 holes at Loma de La Plata in anticipation of such a drillhole spacing study. The outcome of this approach would be an understanding of the degree of grade estimation error associated with particular volumes of mineralisation for a range of drillhole spacing patterns. The grade estimation error and other important aspects of the project data, described in Section 17.10, are considered while assigning Mineral Resource confidence categories.

Pan American plans to proceed to an expanded Preliminary Economic Assessment (PEA) of the Navidad Project, using the Loma de La Plata PEA study published in October 2008 as a basis (Snowden, 2008), focussing on deposits that are likely to produce a high-value silver concentrate with low lead content and maximise the operational mine life. The study will utilise the updated resource models produced as part of this report, in addition to the metallurgical testing of Valle Esperanza and Barite Hill. A more detailed evaluation of the market for silver/copper concentrates is also required. In addition to examining open pit mining methods, those deposits with likely

high strip ratio cutbacks such as Valle Esperanza, Loma de La Plata, and Barite Hill will be evaluated for extraction by underground methods.

More test work with fresh core samples is essential to take Barite Hill and Valle Esperanza to Feasibility Study level to enable Bond Mill work indices to be determined, further tailings settling tests and potential penalty elements including arsenic and antimony.

Further studies of Galena Hill will focus on developing a programme to test the metallurgical variability of the deposit including initial modelling of the geo-metallurgical domains and designing the drill programme for fresh samples. The design of the metallurgical test programme should incorporate opportunities for improving concentrate quality already identified.

Continued exploration in the company’s land package in the Navidad district will be directed towards additional Jurassic-age basins in the Gastre structural corridor with Cañadón Asfalto lithologies. Geochemical sampling techniques should be effective tools to efficiently explore these basins. The distribution of associated potassic-style alteration such as adularia within the regional basins may be detected through the interpretation of the 2008 airborne radiometric survey.

Approximately US$500,000 was expended per month in Argentina on the exploration programme and related activities for the Navidad Property in 2009. Pan American will continue exploration drilling on several open or new targets along the mineralised trends. Infill drilling is planned for Loma de la Plata, Valle Esperanza, Barite Hill, and Galena Hill during 2010. These drillholes will also provide new samples for metallurgical analysis. Additional condemnation and geotechnical drilling is planned for potential future infrastructure sites.

Pan American Silver Corp:

2 Introduction

This Technical Report has been prepared by Snowden Mining Industry Consultants Inc. (Snowden) for Pan American Silver Corp. (Pan American), in compliance with the disclosure requirements of Canadian National Instrument 43-101 (NI 43-101), to disclose relevant information about the Navidad Project. This information has resulted from the acquisition of Aquiline Resources Inc. (Aquiline) by Pan American. On 14 October 2009, Pan American announced a friendly offer to acquire all of the issued and outstanding securities of Aquiline. On 7 December 2009, Pan American acquired approximately 85% of the issued and outstanding shares of Aquiline and extended its bid to 22 December 2009, and on that latter date, Pan American took up an additional approximately 7% of the issued and outstanding shares in the capital of Aquiline. Since the offer to acquire the Aquiline shares was accepted by holders of more than 90% of the Aquiline shares, on 23 December 2009, Pan American provided notice to the remaining shareholders of its intention to exercise its right to acquire the remaining issued and outstanding Aquiline shares pursuant to the compulsory acquisition provisions of the Business Corporation Act (Ontario). Pursuant to the compulsory acquisition, Pan American has been deemed to have acquired the balance of the Aquiline shares not already owned by it on or about 22 January 2010.

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The June 2009 Technical Report (Snowden, 2009) was prepared to disclose information from additional Mineral Resource delineation drilling, Mineral Resource estimations, exploration drilling, and metallurgical test work completed since the previous Technical Reports (Snowden 2006a, Snowden 2006b, and Snowden, 2007). The June 2009 Technical Report was intended to disclose recently updated Mineral Resources at the Calcite NW, Calcite Hill, Navidad Hill, Connector Zone, Galena Hill, Barite Hill, Loma de La Plata, and Valle Esperanza deposits at the Navidad Project. The amended report dated June 2009 included the assay results of independent samples selected by Snowden in April 2009, which were not available at the time of the original filing on SEDAR in May, 2009.

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Pan American Silver Corp:

Pan American is a silver mining company based in Canada and listed on the Toronto Stock Exchange (TSX:PAA) and NASDAQ (PAAS).

Unless otherwise stated, information and data contained in this report or used in its preparation has been provided by Aquiline and Pan American. This Technical Report has been compiled from sources cited in the text by Ms. Pamela De Mark, P. Geo., Senior Consultant at Snowden, and under the supervision of Snowden by Mr. John J. Chulick, formerly Vice President of Exploration at Aquiline, Mr. Dean K. Williams, formerly Chief Geologist at Aquiline, Mr. Damian Spring, Chief Mining Engineer at Aquiline, and by John A. Wells, consultant metallurgist. Ms. De Mark, Mr. Chulick, Mr. Williams, Mr. Spring, and Mr. Wells are Qualified Persons as defined by NI 43-101. Ms. De Mark visited the Navidad Project site in September 2007 and in April 2009. The responsibilities of each author are provided in Table 2.1.

This report is intended to be used by Pan American subject to the terms and conditions of its contract with Snowden. That contract permits filing this report as a Technical Report with Canadian Securities Regulatory Authorities pursuant to provincial securities legislation. Except for the purposes legislated under provincial securities laws any other use of this report by any third party is at that party's sole risk.

Reliance on the report may only be assessed and placed after due consideration of Snowden's scope of work, as described herein. This report is intended to be read as a whole, and sections or parts thereof should therefore not be read or relied upon out of context. Any results or findings presented in this study, whether in full or excerpted, may not be reproduced or distributed in any form without Snowden's written authorisation.

Table 2.1 Responsibilities of each co-author

Author	Responsible for section/s
Dean K. Williams	7: Geological setting; 8: Deposit types
John J. Chulick	4: Property description and location; 6: History; 9: Mineralisation; 10: Exploration; 11: Drilling; 12: Sampling method and approach; 13: Sample preparation, analyses, and security; 15: Adjacent properties
John A. Wells	16: Mineral processing and metallurgical testing
Damian Spring	18: Other relevant data and information
Pamela De Mark	All other sections

Unless otherwise stated, all currencies are expressed in US dollars ($). Coordinates for the Navidad Project grid, including drill coordinates referred to in this Technical Report are in the Gauss Kruger projection, Zone 2, relative to the Campo Inchauspe datum. Mining claims are registered using the Gauss Kruger projection, Zone 2, relative to the WGS 84 datum.

3 Reliance on other experts

There has been no reliance on experts who are not Qualified Persons in the preparation of this report except for information cited in Section 15 regarding Adjacent Properties, where unverified information has been obtained from the company website of Patagonia Gold Plc. at www.patagoniagold.com.

Pan American Silver Corp:

4 Property description and location

Information in this section has been sourced from Snowden (2009).

The Navidad Project is located in Gastre Department in the Province of Chubut, southern Argentina, at approximately 42°24 54 S and 68°49 12 W.

4.1 Land tenure

The Navidad Property is divided into four property claims (registration numbers 14340/04, 14341/04, 14902/06, and 14903/06), each of which is 2,500 ha in area. Additional Aquiline Property claims held or applied for in the name of Minera Argenta S. A. and Minera Aquiline Argentina S.A. in Chubut Province are shown in Table 4.1 and Table 4.2. A plan of the tenements held by Pan American in Chubut Province is shown in Figure 4.1.

In Argentina, exploration concessions are not physically surveyed or staked in the field, but are electronically filed using the Gauss Kruger coordinate system, zone (faja) 2, relative to the WGS 84 datum. There are three levels of mineral rights (which do not include surface rights):

- Cateo – an exploration permit granting any mineral discoveries on the cateo to the applicant. Cateos are measured in units of 500 ha, with a minimum of one unit (500 ha) and a maximum of 20 units (10,000 ha) granted to any holder. Cateo units must be reduced over time relative to the number of units held; the maximum duration for any granted cateo is three years. The holder may conduct prospecting, mapping, sampling, and geophysical surveys, and drilling and trenching after notifying the mining office of the exploration plan.

- Manifestacion de Descubrimiento (MD) – once mineralisation is discovered on a cateo, the cateo lease expires and the permit is upgraded to a manifestacion. The maximum area of a manifestacion is 7,000 ha. A basic environmental impact assessment, a physical survey, and boundary markers are required at this stage.

- Pertenencia – a lease allowing mining. A physical survey and boundary markers are required.

Snowden has not reviewed the land tenure situation and has not independently verified the legal status or ownership of the properties or any agreements that pertain to the Navidad Project. Land tenure aspects have been provided by Aquiline; Snowden has reviewed the information and believes it is reliable.

Table 4.1 Tenement details in Chubut Province operated as Minera Argenta S.A.

Registration number	Property name	Area(ha)	Tenement type*	Property status*
14340/04	Navidad Este	2,500	MD	GMD; LL & MC IP
14341/04	Navidad Oeste	2,500	MD	GMD; LL & MC IP
14352/04	Pampa 1	2,975	MD	GMD; LL & MC IP

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Registration number	Property name	Area(ha)	Tenement type*	Property status*
14367/04	Colonia Este	1,596	MD	GMD; LL & MC IP
14368/04	Colonia Oeste	2,990	MD	GMD; LL & MC IP
14369/04	Sierra	3,469	MD	IP
14370/04	Sierra 1	2,856	MD	GMD
14446/05	Pampa III	2,500	MD	GMD; LL & MC IP
14731/05	Sierra Cacique II	3,025	MD	GMD; LL & MC IP
14732/05	Sierra Cacique I	3,025	MD	GMD; LL & MC IP
14742/05	Carlota 1	3,481	MD	IP
14830/06	Sierra Cacique III	3,484	MD	IP
14831/06	Sierra Oeste	3,105	MD	IP
14832/06	Colonia Este 1	1,622	MD	GMD
14833/06	Colonia Este 2	1,596	MD	IP
14834/06	Sierra Sur 1	2,840	MD	IP
14902/06	Navidad Este 1	2,500	MD	GMD; LL & MC IP
14903/06	Navidad Oeste 1	2,500	MD	GMD; LL & MC IP
15302/07	Trucha A	2,926	MD	IP
15303/07	Alamo A	2,990	MD	IP
15304/07	Mara A	2,486	MD	IP
15305/07	Mara B	2,486	MD	IP
15306/07	Condor C	2,024	MD	IP
15307/07	Condor D	1,957	MD	IP
15323/07	Trucha B	3,001	MD	IP
15426/08	Alamo B	4,752	MD	IP
15439/08	Mara C	2,486	MD	IP
15455/08	Puente 1	2,499	MD	IP
15456/08	Puente 2	2,499	MD	IP
15488/08	Carlota 3	3,448	MD	IP
15493/08	Nina 3	3,448	MD	IP
15525/08	Noelita	9,405	MD	IP

15528/08	Julie	3,577	MD	IP
15529/08	Navidad 3	2,968	MD	IP
15530/08	Navidad II Oeste	2,748	MD	IP
15531/08	Navidad II Este	2,365	MD	IP
15532/08	Puente 3	6,624	MD	IP

Pan American Silver Corp:

Registration number	Property name	Area(ha)	Tenement type*	Property status*
15545/09	Navidad 4	7,000	MD	IP
15550/09	Nuevo Condor	4,800	MD	GMD
15555/09	Los Loros	8,470	CA	IP

*Tenement type codes:
CA = Cateo, exploration permit
MD = Discovery claim (Manifestacion de Descubrimiento), advanced exploration permit
*Property status codes:
IP = In progress. Application submitted
LL = Labour legal, the legal declaration of work that proves existence of mineralisation. Initial process prior to sub-division into mining claims
GMD = Granted discovery claim (Manifestacion de Descubrimiento)
MC = Mining claims (Pertenencias)
JV = Joint venture

Table 4.2 Tenement details in Chubut Province held in the name of Minera Aquiline Argentina S.A.

Registration number	Property name	Area(ha)	Tenement type*	Property status*
14170/03	Calquitas 1	5,165	MD	GMD; LL & MC IP
14171/03	Calquitas 2	5,150	MD	GMD; LL & MC IP
14728/05	Calquitas 3	6,472	MD	GMD
14729/05	Calquitas 4	4,111	MD	IP
15527/08	Flamingo	5,635	MD	IP
14195/04	Regalo II	10,000	CA	JV
14399/04	Regalo III	7,670	CA	JV
14616/05	Regalito 1	2,500	MD	JV
14617/05	Regalito 2	2,500	MD	JV
14642/05	Regalo IV	2,350	CA	JV
14643/05	Regalo V	4,000	CA	JV
14644/05	Regalo VI	4,200	CA	JV
15053/06	Regalito 3	2,500	MD	JV
15054/06	Regalito 4	2,500	MD	JV

*Tenement Type codes:

CA = Cateo, exploration permit
MD = Discovery claim (Manifestacion de Descubrimiento), advanced exploration permit
*Property status codes:
IP = In progress. Application submitted
LL = Labor legal, the legal declaration of work that proves existence of mineralisation. Initial process prior to sub-division into mining claims
GMD = Granted discovery claim (Manifestacion de Descubrimiento)

Pan American Silver Corp:

Registration number	Property name	Area(ha)	Tenement type*	Property status*

MC = Mining claims (Pertenencias)
JV = Joint venture

Figure 4.1 Plan of tenements held by Pan American in the province of Chubut

4.2 Agreements and encumbrances

Silverstone Resources has rights to 12.5% of the eventual silver produced at Loma de La Plata under a "silver stream" agreement. Pan American has represented that Navidad is not subject to any other royalties, back-in rights, payments, agreements, or encumbrances.

In 2006 the government of Chubut Province decreed a three year moratorium on all mining activities, including exploration, in the western part of the Province. This moratorium is due to expire on 29 June 2009, and the government of Chubut has publicly declared that it intends to extend the moratorium for another three years. The government asserts this is to enable the completion of a province-wide map of the mineral potential. The Navidad Property lies outside of and to the east of these "no-mining" zones. The government of Chubut Province has also decreed a Province-wide ban on the use of cyanide for mining purposes and the development of open pit mines. The law states that the government of Chubut Province will accept and review mining proposals, including open pit and cyanide based mining operations, on a case by case basis and determine at that point whether permits may be issued.

4.3 Environmental liabilities

The Province holds the Property administrator responsible for any potential environmental damage liabilities that may arise.

Navidad is flanked by the communities of Gastre to the northwest, Gan Gan to the east and Blancuntre and Lagunita Salada to the southwest. Blancuntre is the closest recognised indigenous community to the Project, with approximately 50 indigenous families living within the town and surrounding area.

Pan American is in the process of completing environmental and social baseline studies for the Project. The bulk of baseline work done to date has been contracted to local Argentine consultants working under the supervision of international firms including Water Management Consultants (WMC)/Schlumberger Water Services, Ground Water International, On Common Ground Consultants Inc., and Klohn Crippen Berger Ltd. Pan American is currently selecting an international consultant that will finalise the baseline work and prepare the future Environmental Impact Assessment (EIA) for the Project.

Key studies underway or completed to date include:

- Climate and air quality
- Surface and groundwater
- Water resources
- Flora, fauna, limnology and ecosystem characterisation
- Archaeology and palaeontology
- Soils, geomorphology, and seismic
- Toxicology and ecotoxicology
- Noise
- Acid Rock Drainage

Renewable energy
Socioeconomic baseline and programs

4.4 Permits

Drilling at the Navidad Project requires a separate permit for each affected tenement valid for one year, subject to the approval of an Environmental Impact Statement (EIS). Pan American is required to submit an EIS which covers the impacts and mitigation/monitoring procedures for the exploration activities, in order to obtain environmental permits. The level of the exploration activity dictates the level of study required.

The Navidad Project is in an advanced exploration stage involving drilling and trenching activities. Aquiline submitted the most recent EIS update in 2008 which was approved in January 2010. Until this EIS update was approved the Project operated under the existing valid permit which was modified in 2008. As a result of the EIS approval, a new drilling permit was issued for a one year period and this new permit allows for the operation of up to eight drill rigs. Rehabilitation of the drilling platforms and impacted areas is carried out throughout the year.

Water rights are treated separately from environmental permits. Aquiline has permitted two extraction wells for use in exploration activities.

Depending on overall project timing, Pan American plans to finalise an Environmental and Social Impact Assessment report for the Project and present it to the provincial Chubut Government in 2010. While the Government has publicly indicated its support for the Navidad Project proceeding, the status of a 2003 provincial law banning open pit mining would need to be clarified before permits for mining can be obtained. Other than the legal/political matter raised above, Pan American does not identify any specific or unique environmental or social risks associated with the Navidad site or Project aspirations.

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5 Accessibility, climate, local resources, infrastructure, and physiography

Information in this section has been sourced from Snowden (2009).

5.1 Accessibility

The nearest towns to the Property are Gastre, with a population of about 500, 40 km to the northwest, and Gan Gan, with a population of about 600, about 40 km to the east. Both towns are located on Provincial Route 4, a gravel highway that passes just north of the Property. Aquiline established offices, accommodation, and facilities for core storage and logging in Gastre and to a lesser degree in Gan Gan. The Property is accessible year round except in very wet conditions.

Daily scheduled flights are available from the city of San Carlos de Bariloche, a tourism centre with a population of approximately 100,000, located about 355 km by road to the northwest. Daily flights are also available through Trelew, located about 390 km by road to the southeast near the coast, with a population of approximately 90,000. The nearest airport, which has regularly scheduled flights, is located in Esquel, about four hours drive to the southwest by gravel road. The provincial capital of Rawson, located 20 km east of Trelew, has a population of approximately 23,000. Aquiline established an office from which to advance the technical studies of the Project in Puerto Madryn, a city with a population of approximately 70,000, located 60 km north of Rawson. There are at least three scheduled flights per week between Puerto Madryn and Buenos Aires. Pan American also maintains offices in Buenos Aires and in the regional centre of Ingeniero Jacobacci, which has a population of approximately 8,000, located two hour’s drive to the north of Gastre.

5.2 Climate

The climate is semi-arid with average annual temperatures ranging from 1°C to 20°C. High winds frequently occur from October through December, but may also occur throughout the year. Annual precipitation averages between 5 mm to 10 mm per month, but during the winter months from May to August, higher accumulations ranging from 15 mm to 20 mm may occur as either rain or snow. Field activities run throughout the year and are not curtailed by weather conditions.

5.3 Infrastructure and local resources

Pan American's base of operation for the Navidad Project is in Gastre. Facilities include offices, modular living facilities, and core-storage warehouses. Communications are provided by land line telephone service, national mobile phone operator, and a satellite internet dish. The modular living facilities provide lodging and meals for up to 20 people. The warehouses include three drill core storage sheds, a logging and sampling shed, metal shop, vehicle workshop, and a regional exploration office. In the logging shed there are four diamond saws used to cut drill core.

In Gan Gan the company has built two core storage facilities as well as an office on land purchased on the western edge of town in 2007. The office serves as a base of operation for its social and community relations personnel, while the warehouses contain older drill core from the Navidad Property.

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On the Navidad Property a small camp facility has been installed with electrical power provided by several small generators. Communication is provided by a satellite internet uplink. Other infrastructure on site includes storage areas for drill supplies. There are two water bores authorised by the Chubut Province Hydrology Department to pump water for use with diamond drilling. Water pumping is accomplished by one of two company owned water pumps. To provide access for drilling a total of 26 km of access roads have been constructed on the Property.

During 2008, the drilling contractor, Boart Longyear, installed a transportable 60-person camp in the Yanquetru Valley, on company-owned land to the south of the Project. The company installed a water tank and sewerage facilities in support of the camp.

5.4 Land access

Access to land for drilling and other exploration activities is allowed through outright surface ownership as well as through a series of easement contracts with the remaining surface owners. Aquiline continued land acquisition to facilitate unimpeded land access to the Navidad Project through land swap deals and direct land purchases.

Pan American reports the current status of its land acquisition process as follows:

- Santana Sarmiento Property: Land swap completed
- Santana Horacio Property: Direct purchase of land completed
- Montenegro Succession: Direct purchase of land with agreements signed and title transfer to occur in July 2009
- Raileff Succession: Land swap agreements signed, titles to be transferred when the IAC (Colonisation Office) grants property to the Raileff family
- Llanquetru Eleuterio Property: In progress

Figure 5.1 shows a plan of the properties now owned by Pan American shaded in red, while agreed sales transactions or negotiations continue on the properties shaded in green. The blue outlines represent the previous cateos, now re-applied for as Manifestaciones de Discubrimientos (MD), while the dashed bold blue line represents the MDs covering the main area of the Project. The properties previously owned by Sarmiento and Horacio Santana contain the Loma de La Plata Project and the favoured sites for the associated waste dump, tailings dam, and concentrator (Snowden, 2008).

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Figure 5.1 Navidad surface landholders with status of negotiations or agreements

5.5 Physiography

The Property is located in the Patagonian Plateau region with steppe vegetation characterised by low and compact bushes of grass and by stocky shrubs of less than a metre high. Elevation ranges from 1,060 m to 1,460 m with gentle topographic relief interrupted by local structurally controlled ridges.

Pan American Silver Corp:

6 History

Information in this section has been sourced from Snowden (2009), which excerpted and updated from Cuburu (2007).

The first exploration programme that included the Navidad Project area consisted of a preliminary regional geochemical sampling programme conducted by Normandy Argentina (Normandy) in mid 2000 to locate additional deposits to supplement those known at its Calcatreu Property, a gold and silver deposit located approximately 80 km from Navidad. The programme consisted of 1,200 bulk leach extractable gold (BLEG) stream sediment samples taken from drainage systems overlying Jurassic volcanic rocks in Chubut Province in the general vicinity of Calcatreu, Mina Angela, Gastre, Lagunita Salada, Gan Gan, and other areas. This programme took place on what was then considered open exploration ground, and resulted in the identification by Normandy of various anomalies, including the Flamingo Prospect and Sacanana, which is today known as Navidad.

In January and February 2002, Newmont Mining (Newmont) purchased Normandy’s worldwide mining interests, and in March 2002, Newmont decided to sell all of its interests in Argentina. In September 2002, IMA signed a confidentiality agreement (Confidentiality Agreement) in order to obtain a copy of the Information Brochure and technical data related to Newmont's Argentinean interests, which included the Calcatreu Project. In December 2002, IMA applied for an exploration concession (cateo) over the area formerly known as Sacanana and now known as Navidad, utilising and relying upon the Normandy BLEG data (known as BLEG A), and began undertaking a regional exploration programme over the Navidad area, including regional mapping and sampling. From December 2002 to July 2006, IMA conducted diamond drilling, geochemical sampling, geophysical exploration, and Mineral Resource estimates at Navidad.

In January 2003 Aquiline entered into an agreement with Newmont, which was completed in July 2003, to purchase all of the shares of Normandy and Newmont’s 100% interest in Calcatreu, and acquired all of Newmont’s assets including the BLEG A data. In May 2003 Aquiline reviewed the BLEG A data and found that the ground covered by the BLEG A data had already been claimed by IMA. After failure to receive a credible response from IMA as to how they could otherwise have made a legitimate discovery at Navidad without having breached the terms of the Confidentiality Agreement, Aquiline went on to file suit in the Supreme Court of British Columbia in March 2004.

The Supreme Court of British Columbia awarded ownership of the Navidad Project to Aquiline on 14 July 2006 following a court case with IMA where IMA was found to have breached the Confidentiality Agreement. IMA subsequently appealed to the Court of Appeal for British Columbia, but lost the appeal by unanimous decision in June 2007. An Application for Leave to Appeal to the Supreme Court of Canada was filed by IMA in September 2007. Sole ownership rights were granted to Aquiline by the Supreme Court of Canada on 20 December 2007, subject to Aquiline making payment to IMA which would reimburse the latter for its accrued exploration expenditures up to the July 2006 court decision. Aquiline's final payment to IMA was made on 8 February 2008, giving Aquiline full ownership of the Project.

Since October 2006, Aquiline undertook diamond drilling, geophysical and geochemical exploration, metallurgical test work, resource estimates (Snowden, 2007), including the

2009 Mineral Resource estimate, and a Preliminary Economic Assessment for Loma de La Plata (Snowden, 2008).

On 14 October 2009, Pan American announced a friendly offer to acquire all of the issued and outstanding securities of Aquiline. On 7 December 2009, Pan American acquired approximately 85% of the issued and outstanding shares of Aquiline and extended its bid to 22 December 2009, and on that latter date, Pan American took up an additional approximately 7% of the issued and outstanding shares in the capital of Aquiline. Since the offer to acquire the Aquiline shares was accepted by holders of more than 90% of the Aquiline shares, on 23 December 2009, Pan American provided notice to the remaining shareholders of its intention to exercise its right to acquire the remaining issued and outstanding Aquiline shares pursuant to the compulsory acquisition provisions of the Business Corporation Act (Ontario). Pursuant to the compulsory acquisition, Pan American has been deemed to have acquired the balance of the Aquiline shares not already owned by it on or about 22 January 2010.

7 Geological setting

Information in this section has been sourced from Snowden (2009).

7.1 Regional geology

The Navidad Project is located on the southwest edge of the Northern Patagonia Massif in southern Argentina. This boundary of the massif is coincident with the "Gastre Fault System", which was originally interpreted as a large-scale dextral shear zone (Figure 7.1). This mega-structural feature is now believed to be the result of continental-scale northeast to southwest extension that produced through down-faulting a series of northwest to southeast trending half grabens and tectonic basins. (von Gosen et. al. 2004)

Granitoid rocks of the basement in northern Chubut Province belong to the Palaeozoic age Mamil Choique and Lipetren formations. Locally these rocks are exposed at surface in windows through the overlying Mesozoic age volcanic and sedimentary rocks. At Navidad the Mesozoic sequence consists of the Lonco Trapial Formation and overlying Cañadón Asfalto Formation. The latter of these formations hosts the Navidad mineralisation.

Chubut Province was tectonically active during the Jurassic with abundant evidence of syn-sedimentary faulting observed in the Cañadón Asfalto Formation. Continued post- sediment tectonic activity resulted in the faulting, tilting, and local folding of the Lonco Trapial and Cañadón Asfalto formation stratigraphies. This resulted in the formation of a series of northwest trending half and full horsts and grabens.

Overlying these tilted Jurassic age volcanics and sediments are the generally flat lying sediments and pyroclastic rocks of the Cretaceous age Chubut Group Formation. To the east and south these are covered by Tertiary age plateau basalts.

Figure 7.1 Regional geology plan

7.2 Local geology

The local geology as shown in Figure 7.2 consists of exposures of the Palaeozoic age Mamil Choique Formation along the western side of the map area. This unit is composed of red and grey granitoids and aplite dykes with quartz-rich pegmatites.

These crystalline basement rocks are overlain by Jurassic age rocks of the Lonco Trapial and Cañadón Asfalto formations. These formations are unconformably overlain by the Cretaceous age Chubut Group of the Cerro Barcino Formation of continental sandstones, conglomerates and tuffs and by plateau basalts of the Miocene age Pire Mahuida Volcanic Complex.

The contact between the Mamil Choique Formation basement rocks and the volcanic rocks of the Lonco Trapial Formation is located 6.5 km southwest of the Navidad Trend.

Figure 7.2 Local geology plan from Andolino (1999)

Units present in Navidad Project Area listed below:
39 Alluvial and colluvial deposits, fine to medium sands, silts and clays subordinate; disperse boulders
38 Deposits in lows and lakes. Silts and clays; salts
36 Deposits that cover undifferentiated layers. Sands, gravels and silts
35 Deposits that cover the second layer in the Gan Gan low. Sands, gravels and silts
34 Deposits that cover the first layer in the Gan Gan low. Sands, gravels and silts
30 Pire Mahuida Volcanic Complex. Basalts (flows), nepheline
16 Colhué Huapi Formation (continental). Tuffs, lapilli tuffs and sinters
13 Catán Lil Ignimbrites. Rhyolitic ignimbrites.
10 La Colonia Formation. (continental, lagunal, marine). Pelites; subordinate fine sandstones
7 Chubut Group – Cerro Barcino Formation (continental). Sandstones, conglomerates and tuffs
6 Cañadón Asfalto Formation (continental lacustrine). Fine sandstones, limestones and volcanics

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4 Lonco Trapial Formation. Ignimbrites, andesites, porphyritic andesites, andesite breccias
3 Garamilla Formation. Ignimbrites and rhyolite lavas and dacites
1 Mamil Choique Formation. Red and grey granites; sheared granites 1a: Aplite dykes and quartz
(translated from the original Spanish by Lhotka, 2003)

7.2.1 Lonco Trapial and Garamilla formations

The Lonco Trapial Formation is the oldest Jurassic age unit located in the vicinity of the Navidad Project area. It forms the northeast contact with the exposed batholithic rocks of the Mamil Choique Formation. The unit is characterised by lavas and volcanic breccias of intermediate composition. Locally it may become intercalated with the typically more felsic and pyroclastic rocks of the Garamilla Formation. This latter unit consists of multiple pyroclastic flow events and reworked volcaniclastics.

7.2.2 Cañadón Asfalto Formation

This unit stratigraphically overlies the Lonco Trapial and Garamilla formations. Within the portion of the government geologic map shown in Figure 7.2, the spatial distribution of this unit is restricted to the area immediately surrounding the Navidad Project and an area on strike to the southeast in the lower right hand corner of the map. The formation consists of lacustrine sedimentary rocks, which grade laterally and vertically from lower arkose basal conglomerates and sandstones to greywacke that give way to mudstones at higher stratigraphic levels. Interbedded with both the arkose, greywacke and shales are thin horizons of carbonaceous marls and limestone, some of which contain stromatolites.

Within the sedimentary sequence are three distinguishable volcanic lava flows. These appear conformable to the sedimentary stratigraphy and are believed to have been emplaced in sub-areal to sub-aqueous environments. Pyroclastic and phreatic-magmatic events precede the extrusion of the latter two lavas. Evidence of these events is preserved as pyroclastic horizons within the volcanic-sedimentary sequence and what is interpreted to be a maar – diatreme complex. The lavas consist of an intermediate composition rock referred to as andesite and two trachyandesite units referred to as the Lower and Upper latite units. The lower of these units is distinguishable from the upper by the ubiquitous presence of monolithic xenoliths in the former.

No obvious intrusive rocks are identified within the Project area with the exception of feeder dikes of the Lower Latite unit. The present interpretation is that the latite units are the product of volcanic lava flows and flow breccias, though at Navidad Hill, the base of the latite has so far not been found by drilling, leaving open the possibility of a dome in this area.

7.2.3 Depositional setting

The rocks of the Lonco Trapial and Cañadón Asfalto formations were deposited into an actively subsiding tectonic basin. Sub-basins control the distribution of lacustrine sediments resulting in rapid facies changes. Source areas for the sediments appear to have changed over time. Early arkoses are believed to have been derived from highlands of the crystalline basement rocks to the southwest. The greywacke sediments of intermediate composition are believed to been sourced from the north. There is evidence the sedimentary cycles may have been interrupted by block faulting and tilting with erosion and re-sedimentation. The environment during the deposition of the volcanics of the Cañadón Asfalto Formation appears to have varied over time from place to place as exhibited by textures and characteristics for both sub-areal and submarine emplacement.

7.2.4 Structure and control of mineralisation

At the regional scale the main structural orientations within the Navidad District are northwest to southeast, east-northeast to west-southwest, and north-northwest to south-southeast. The depositional basin containing rocks of the Cañadón Asfalto Formation is approximately 55 km long and 10 km wide with the long axis trending northwest to southeast. Ground gravity surveys show a linear northwest to southeast boundary between high and low Bouguer anomalies, which are interpreted to represent structures affecting the crystalline basement rocks. The Navidad Project is located at the northwestern end of the basin. Mineralisation along the Navidad Trend from Marcasite Hill to Calcite NW exhibits a strongly linear northwest to southeast affinity. The Arco Iris Fault at Loma de La Plata is also orientated northwest to southeast.

The Navidad depositional basin is terminated to the northwest by an east-northeast to west-southwest trending structure that juxtaposes the volcanic-sedimentary sequences against rocks of the Lonco Trapial and Mamil Choique formations. To the southeast the Cañadón Asfalto facies are presumed buried beneath Quaternary cover in a large east-northeast to west-southwest trending depression.

The entire Navidad Project area is crossed by north-northwest to south-southeast structures that define the limits of many of the bedrock exposures and are believed to have offset stratigraphy with a dextral sense of relative movement. Observed displacements on these structures range from several metres to over a kilometre.

7.3 Property geology

7.3.1 Lithology

A simplified version of the Navidad Project geology is shown in Figure 7.3. The corresponding stratigraphic column for the Project area is shown in Figure 7.4. The oldest rocks are the crystalline basement rocks of the Mamil Choique Formation located in the southwest corner of the map area. These basement rocks are overlain by a sequence of pyroclastics, volcanic agglomerates and lavas of the Lonco Trapial Formation. These rocks are exposed along a northwest to southeast trending strip in the southwest quadrant of the map area and in the valley northeast of the Sauzal Fault along the Navidad Trend. They are also exposed on the southeast projection of the Esperanza Trend at the Fold Zone.

Figure 7.3 Property geology plan

Figure 7.4 Simplified Navidad Project stratigraphic column

The welded pyroclastics of the Lonco Trapial Formation exposed to the southwest of the map area are also found directly north of Calcite Hill and in deep drilling along the Navidad Trend below the Sauzal Fault. Here they are interbedded with juvenile volcaniclastics derived from the same flows. A drill hole northeast of Navidad Hill crossed in excess of 500 m of this volcaniclastic/pyroclastic sequence without encountering the underlying agglomerates or basement rocks. This thick sequence of rock is generally oxidised as denoted by its characteristic red colour and in Section 8 of this report are likened to “Red Beds”.

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Stratigraphically above the Lonco Trapial volcanic sequence and forming the base of the Cañadón Asfalto Formation are coarse clastic sediments of arkosic composition. Basal conglomerates of the arkoses may contain boulders up to 2 m in diameter. They are composed almost exclusively of angular grains of quartz and feldspar derived from the Mamil Choique Formation. Locally the arkoses contain horizons of limestone, some with stromatolites. Coarser beds include pebble to cobble size clasts of granite and metamorphic rocks. These beds may locally exhibit cross-bedding sedimentary textures. These sediments extend from the valley floor southwest of the Argenta Trend to the Esperanza Trend. Intersections from drillholes southeast of Loma de La Plata and further south on the Argenta Trend indicate the arkoses are interbedded with thick sequences of argillaceous shales. At surface the coarser arkoses horizons are resistive and form extensive exposures. The shales are erosionally recessive and are rarely if ever exposed at surface.

At Loma de La Plata and between the Esperanza and Navidad trends there are no arkose sediments. In their place intercalated with the argillaceous black shales are mature greywackes of intermediate volcanic composition. These are deposited in rhythmic sequences consisting of pebble conglomerates that grade normally into coarse muddy sandstones. The greywackes locally contain thin carbonaceous horizons.

Above the greywackes from Loma de La Plata to Sector Z and between Esperanza and Navidad trends southeast of Calcite NW are argillaceous black shales. These sediments contain limestone horizons and zones with intercalations of coarser grained muddy sediments. They are rich in organic carbon and locally may contain thin coal seams. In the northwest to central portions of the Esperanza Valley the shales may also contain horizons of pyroclastics with varying degrees of re-working with thicknesses that range from 1 m up to 10 m. At Galena Hill the shales host massive sulphide replacement bodies at their lower contact with the latite lavas. At several of the Project deposits these shales contain Pb and Zn mineralisation distal to the higher grade silver zones.

Contemporaneous with the deposition of the sediments within the Project area, there were a minimum of three distinct extrusive lava and multiple pyroclastic volcanic events. The oldest of the lavas are fine-grained and of intermediate to mafic composition. These are referred to at the Project as andesite. These rocks are believed to been extruded sub-aerially as the auto-brecciated tops of the flows show the effects of thermal oxidation. These lavas were either simultaneously deposited within two separate basins, one dominated by arkoses and the other by black argillaceous shales, or there were multiple andesite eruptive events. On the Argenta Trend the andesites are inter-bedded with arkoses and on the southern end of the Navidad Trend they are inter-bedded with black shales. At the northwestern end of the Navidad Trend and north of Provincial Route No. 4 they are overlain by pyroclastics and other latite lava flows with no intervening sediments. The andesite lavas are generally not mineralised; however, locally they can host Ag-Cu mineralisation. The best known mineralisation hosted in andesite is located at the southern limit of the Connector Zone. Here the tectonically brecciated and hydrothermally altered andesite return grades of up to 11 kg/t Ag in surface rock chip samples. There are also mineralised showings in andesites south of Loma de La Plata on the Argenta Trend and at the Fold Zone at the southeast end of the Esperanza Trend.

The next extrusive lava event produced what is referred to on the Project as the Lower Latite unit. It is actually a hybrid consisting of a trachyandesite contaminated by quartz, which appears as rounded 1 mm to 3 mm quartz phenocrysts with reaction rings in quantities ranging from 1% to 5%. The Lower Latite also contains cognate clasts 0.5 cm to 3 cm in size of fine-grained material of the same composition without quartz phenocrysts. On the Project these are referred to as “xenoliths”. The Lower Latite was preceded by a pyroclastic eruption that produced pumice bearing ash tuff. At Navidad Hill and Galena Hill the exposed volcanic sequence is andesite, pumice tuff followed by the Lower Latite with no intercalated sediments. The Lower Latite lava is restricted in distribution to the northern end of the Argenta Trend and the northern half of the Esperanza and Navidad trends. These lavas host high grade mineralisation at Calcite Hill, where the Upper Latite lavas are believed to have been removed by erosion prior to the deposition of the black shales. The Lower Latites also host mineralisation together with the Upper Latites at Galena Hill.

The last extrusive volcanic event produced the Upper Latite lava flows. These rocks are macroscopically identical to the Lower Latite except they do not contain cognate clasts. Potentially these autoclasts were completely reabsorbed by the magma before their extrusion. It is believed the initial eruption of the Upper Latite encountered sufficient ground water to create a maar – diatreme complex located at Calcite NW. Evidence supporting this hypothesis is a 2 km wide zone of milled matrix breccia containing rounded clasts of the welded pyroclastic flows and Lower Latite lavas. Horizons of reworked pyroclastics observed within the sediment sequences at the northern end of the Navidad Trend may represent surge deposits. Continued eruption of the Upper Latite lavas led to its distribution over an area minimally 60 km2 in size including the entire length of the Argenta, Esperanza and Navidad trends and north of the Provincial Route No. 4. At the southeast end of the trend the groundmass of the lava is glassy and has devitrified to form spherulites. At the northwest end of the Argenta Trend and on the Esperanza and Navidad trends the lava is interbedded with greywackes and shales. The Upper Latite lava hosts practically all of the Ag-Cu mineralisation at the Loma de La Plata and Esperanza Valley deposits and a larger portion of the mineralisation at the Navidad Hill and Galena Hill deposits

7.3.2 Structure and control of mineralisation

Collectively the individual mineralised deposits along the Navidad Trend exhibit a strong northwest to southeast lineation. A few observed small mineralised veins and breccia dikes located along the trend also exhibit northwest to southeast to north-northwest to south-southeast orientations. No large potential feeder structure common to all the deposits has yet been discovered. If such a structure exists, it is likely that post-mineral movement on the Sauzal Fault laterally displaced it from beneath the known mineralised bodies.

At the individual deposit scale the mineralisation is clearly controlled by zones of primary or secondary porosity. Examples of this are the upper latite lavas at Esperanza Valley and Loma de La Plata and volcaniclastic horizons at the Connector Zone and Calcite NW. These zones are often capped by impermeable horizons. These aquitards effectively capped the ascending hydrothermal fluids and forced lateral migration outward from the plumes. The result was the formation of mineralised bodies with strataform geometries.

Almost all the Project mineralised deposits are contained within structural blocks separated from each other by three major structures. These structures are believed to be pre-mineralisation in some cases and are definitely post-mineralisation in others as evidenced by these structures truncating mineralisation. The most influential of these post-mineral structures are the Sauzal, Esperanza and Arco Iris faults. The Sauzal Fault is located along the northeast side of the Navidad Trend and dips shallowly to the southwest. This structure truncates the mineralisation at depth on the Galena Hill, Connector Zone, Navidad Hill and Calcite Hill deposits. The Esperanza Fault located along the Esperanza Trend has resulted in the drag folding of the host lithologies of the Valle Esperanza deposit. The Arco Iris Fault is located in the northern end of the Argenta Trend. This steeply northeast dipping fault limits the Loma de La Plata mineralised deposit to the southwest where it juxtaposes it against unmineralised andesite. The Barite Hill deposit is also interpreted to be affected by post-mineral low angle faulting, potentially analogous to the interpreted movement on the nearby and similarly orientated Sauzal Fault.

8 Deposit types

Information in this section has been sourced from Snowden (2009), which incorporated contributions from Sillitoe (2007).

Navidad mineralisation is clearly epithermal in nature as demonstrated by widely observed open space filling by crustiform and cockade textures of the carbonate, barite and sulphide mineral assemblages. The abundance of base metals combined with gangue mineralogy of carbonate and barite dominate over silica, indicates the deposit should most appropriately be categorised as an intermediate – rather than a low sulphidation epithermal deposit. The alteration and sulphide mineral assemblages are incongruent with high sulphidation epithermal style of mineralisation, although late-stage kaolinite and reported minor hydrothermal alunite could imply the late ingress of a hypogene acidic fluid.

The Navidad deposits formed post-deposition and lithification of the containing greywacke and shale sedimentary sequences of the Cañadón Asfalto Formation. Evidence supporting this is open fractures filled by calcite and barite within the sediments overlaying zones of mineralisation. The depth of formation is believed to be moderately shallow, potentially on the order of 400 m to 500 m below the paleosurface. This is consistent with findings from calcite fluid inclusion studies by Lang (2003) that indicated the hydrothermal fluid was vapour dominated with a temperature of homogenisation below 200°C. Despite being formed near the paleosurface, no concrete evidence has ever been observed to indicate an exhalative facies to the mineralisation. The semi-massive sulphides at Galena Hill are clearly replacement in origin. The finely laminated carbonates postulated to represent exhalative products are in fact stromatolitic limestone. Hence, Navidad is not analogous to shallow-water volcanogenic massive sulphide (VMS) deposits like Eskay Creek in British Columbia as has been suggested by previous investigators.

The ore deposit model presented in Figure 8.1 is a schematic reconstruction at the time of emplacement for either Galena Hill or Navidad Hill. Vein and veinlet stockworks grade upwards into hydrothermal breccias believed to have been created by over pressuring of the ascending hydrothermal fluids within the latites. Breccia textures range from crackle to rotated and commonly contain a high component of fine sediments in their matrix. The breccias locally contain displaced banded carbonate and mineralised clasts indicating multiple inter-mineralisation brecciation events. The breccias are cemented by carbonate and barite gangue and sulphide minerals. At Galena Hill, the breccia clasts become progressively more intensely replaced upwards by the sulphide cement, resulting in irregular bodies of semi-massive sulphide. The breccia and related semi-massive sulphide bodies at Galena Hill terminate abruptly upwards against a finely laminated limestone bed of stromatolitic origin. The overlying carbonaceous mudstone contains Zn mineralisation and can be massively silicified for up to 5 m above the upper limit of the high grade Ag-Pb mineralisation.

Figure 8.2 is a schematic drawing of lateral-flow style mineralisation away from the main ascending plume centres based upon observation made at the Loma de La Plata deposit. Here relatively thin horizons of latite lavas are interbedded with sediments. The silver plus minor copper mineralisation is preferentially localised along the top of the upper latite flow unit in either flow-top auto breccias or in crackle breccias. These breccias are likely to have resulted from even minor tectonic deformation due to the sharp rheology contrast between the brittle latite and the overlying sediments. Disseminated Zn mineralisation in the sediments forms halos both above and below the main Ag horizon of mineralisation.

The preferred hypothesis for the transport of the metals and their deposition is dependent upon the redox state of the underlying red bed and ignimbrite units and the reducing state of the overlaying carbonaceous sediments. The transport mechanism further requires physical fluid-flow conditions of structural conduits and the primary or secondarily induced permeability of the breccias pipes and latite flow units. Ascending hydrothermal fluids passing through the underlying red beds would rapidly become buffered and oxidised, thus resulting in oxidation of sulphide sulphur in solution to sulphate. These fluids would be capable of precipitating carbonate, barite and specular hematite in the veins and veinlets within the red beds, but not Fe, Ag or base metal sulphides. The content of these metals could simply have been transported to higher levels within the hydrothermal system. Upon entry to the overlying relatively reduced rock package, the fluids became more reduced, allowing sulphide formation to commence, presumably as a result of admixture with sulphide-bearing groundwater from the organic carbon-rich, upper sedimentary unit. Interestingly, the Ag mineralisation in the basal grey sedimentary unit, immediately above the red beds, at Barite Hill is rich in native Ag, a mineral that could form after only relatively minor reduction of the ascendant fluids and without the need for reduced sulphur.

This model for Navidad, with mineralisation control by a district-wide redox interface, is reminiscent of red bed Cu and Ag deposits, where fluids ascending through thick red bed sequences leach Cu and/or Ag, along with other metals, and deposit them on contact with reduced horizons. The red bed silver deposits, such as Nacimiento in New Mexico in the United States, are also characterised by sulphur-poor mineral species, such as native Ag and acanthite. The difference is that at Navidad the mineralising fluid was epithermal in origin rather than being basinal brine as in the case of the red bed deposits.

The broadly strataform nature of the Navidad mineralisation is rather uncommon for an intermediate-sulphidation epithermal silver deposit, most of which tend to be of vein type (e.g. Fresnillo in Mexico, Arcata in Peru, Martha in Santa Cruz province, Argentina). Potential analogous deposits include the Jardin Cu-Ag deposit of northern Chile. Here strata-bound cupriferous sulphide mineralisation is associated with the upper brecciated and unwelded portion of a pyroclastic flow overlain by organic-rich tuffaceous lacustrine sedimentary rocks (Lortie, 1987). Another example of a broadly strataform deposit is San Cristóbal in Bolivia. Although the feeders for the San Cristóbal deposit are largely confined to a dacite dome complex, the bulk of the silver-zinc-lead mineralisation is hosted by lacustrine sedimentary rocks rather than by lava as at Navidad.

Figure 8.1 Schematic reconstruction of Galena Hill from Sillitoe (2007)

Figure 8.2 Schematic reconstruction of Loma de La Plata from Sillitoe (2007)

9 Mineralisation

Information in this section has been sourced from Snowden (2009), which excerpted and updated from Kain (2007) and Allo, Paolini, and Williams (2009).

In all of the deposits and mineral showings the gangue minerals are principally calcite with or without barite and a much lower proportion of silica. Visibly recognisable ore minerals are native silver, grains and clots of black sulphides containing argentite\acanthite and discrete grains of sphalerite, galena, chalcopyrite, cuprite, bornite, native copper and copper carbonates. Distinct styles of mineralisation are reflected in the differences in ore minerals and proportion of gangue between the deposits. Various pulses of mineralisation are observed, principally at Galena Hill. With the exception of the latter, pyrite and sulphides in general are relatively scarce.

The principal mineral association of interest is Ag-Pb. Other associations of interest are Ag-Pb-Cu and Cu-Ag or more rarely Ag-Zn. Occasionally there is Ag only, or Cu-Pb-Zn or simply isolated occurrences of these base metals. This further suggests that deposition occurred through successive pulses of mineralisation. So far as it is known to date, gold is totally absent from the system.

Mineralisation is preferentially hosted in lavas with the upper latite containing the dominant proportion, followed by the lower latite and then rarely by the andesite. Deposits with the dominate portion of mineralisation within lavas include Loma de La Plata, Valle Esperanza, Calcite Hill, and Galena Hill. Sedimentary rocks and volcaniclastics can also contain significant mineralisation. Deposits where the mineralisation is dominantly hosted by these rock types include Calcite NW, Navidad Hill, Barite Hill, and the Connector Zone.

High grade mineralisation is nearly always correlative with either primary or induced secondary porosity of the host rocks. Examples of primary porosity include coarse volcaniclastic horizons and auto-brecciated lava flow tops. Secondary porosity occurs as crackle brecciation of the brittle lava flows, hydrothermal eruption breccias, and tectonic breccias. At both Valle Esperanza and Loma de La Plata the crackle brecciated upper latites are believed to have acted as aquifers bounded upward by what are interpreted as bedding plane faults with the overlaying sediments. The capping lutitic sediments created effective aquitards that would have greatly promoted the lateral migration of the ascending hydrothermal fluids. Mixing of the reduced formation waters within the aquifers with the oxidised and metal-laden hydrothermal fluids is hypothesised to have been a principal triggering mechanism for the precipitation of ore minerals. Locally the argillaceous mudstones above the upper latite are fractured and infilled by calcite. This indicates that the host rocks were buried and the sedimentary rocks lithified prior to the mineralising event.

To date the general Navidad Project is comprised of eight individual mineral deposits in three separate mineralised trends referred to as the Navidad Trend, the Esperanza Trend, and the Argenta Trend. The six deposits in the Navidad Trend are essentially contiguous and include, in a 5.8 km alignment from northwest to southeast, Calcite NW, Calcite Hill, Navidad, Connector Zone, Galena Hill, and Barite Hill. The Valle Esperanza deposit occurs on the east flank of the Esperanza Trend and is found approximately 370 m to the south-southwest of Galena Hill. The Loma de La Plata deposit occurs along the northern portion of the Argenta Trend and lies approximately 2.2 km southwest from the centre of Calcite Hill.

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9.1 Calcite NW

A plan of Calcite NW is shown in Figure 9.1. Calcite NW is located stratigraphically in the upper sedimentary package found directly above the latite unit. This package is comprised of mudstone, sandy volcanic tuffs, tuffaceous sandstones, lapilli tuffs, and volcaniclastic intervals. In general the layers with a significant tuffaceous component exhibit a strong argillic alteration.

Mineralisation occurs disseminated in the sediments where it is observed as galena with occasional scarce chalcopyrite. Facies with high permeability, such as the tuffaceous sandstones and volcanic tuffs, are preferentially mineralised. Towards the northwest the mineralisation is characterised by Pb with low Ag and is hosted mainly by tuffs and pyroclastic units. In the central to southwest area of Calcite NW, Ag and Pb mineralisation with low grade Cu and occasional Zn mineralisation are hosted by sandy mudstones and tuffaceous sandstones.

The main mass of mineralisation is located along the axis of the general Navidad Trend. There is a strong stratigraphic control. The wacke and tuffaceous units host the mineralisation within the inter-grain pore space. Mineralisation is interpreted to have been channelled through the migration of hydrothermal fluids between the nearly impermeable mudstone units.

There are two marker units within the deposit. One of these is a green lapilli tuff which is generally only weakly mineralised, and the second marker is generally taken as the base of mineralisation. The green lapilli tuff, between 5 m to 10 m thick, is found near the top of the deposit in a relatively lead-free zone. The second marker, known as the Galena Marker, is approximately 80 cm thick and is comprised of a type of massive dark mudstone with disseminated crystalline and irregular micro-veinlets of galena with high lead values and silver. Lead mineralisation with scarce to absent silver mineralisation is occasionally encountered up to 1 m below these units in a volcaniclastic layer or in a coarse detrital facies.

Mineralisation at Calcite NW takes the form of three long and tabular to slightly synformal bodies. The main body lies from the surface to a depth of 130 m below surface and has an average overburden thickness of approximately 60 m. It has a strike length of 1,825 m towards the northwest, a width between 350 m to 500 m, and a thickness between 10 m and 80 m. The mineralised body plunges gently to the northeast with a dip between 1º to 5º. The base of the main body is normally identified by the Galena Marker.

Towards the south-eastern end of the deposit, a smaller lens lies close to the surface parallel to the main body and about 80 m above it. It has a regular shape 275 m long, up to 250 m wide and between 20 m and 40 m thick.

Another elongated lens of mineralisation lies between 15 m to 50 m below and parallel to the northern end of the main body. The body is 1,000 m long, between 200 m and 350 m wide, and ranges between 10 m and 30 m in thickness.

Figure 9.1 Plan of Calcite NW

9.2 Calcite Hill

A plan of Calcite Hill is shown in Error! Reference source not found.. The mineralisation is hosted principally in the latite with xenoliths unit (lower latite) and occurs upwards for a few metres above the contact with the overlying upper sedimentary or pyroclastic package depending on the sequence. The style of mineralisation is typically banded epithermal vein filling and stockworks in breccias developed in the brittle massive portions of the flow. Where present in the upper sedimentary package, mineralisation occurs as disseminations infilling the primary porosity as well as micro-veinlets that are comprised of argentiferous Pb and Zn sulphides along with interstratified galena.

Gangue mineralisation is comprised of calcite, minor silica, and barite either white in colour or as a caramel-coloured variety that occurs almost exclusively at Calcite Hill although it has been occasionally identified on nearby Navidad Hill. High grade mineralisation is comprised of galena, black sulphides, native silver, and occasional chalcopyrite. The overlying geochemical signature is Ag-Pb with minor Cu.

A zonation of the mineralisation hosted in the latite unit is exhibited in the sequence of the three principal zones which in descending depth order are:

- An upper zone with principally Pb mineralisation with minor Ag, and minor to absent Cu
- An intermediate zone with high grade Ag mineralisation and proportionally less Pb and moderate Cu
- A lower zone with primarily silica fracture filling, low in sulphides and Ag mineralisation

Similar to the Galena Hill deposit, the mineralisation at Calcite Hill terminates abruptly at the lower contact of the latite unit with the reddish basal sedimentary unit, which exhibits poor to no permeability. An interpretation is that the latite, being confined as well on the upper contact with the mudstones which frequently act as fluid barriers, served as a unit with secondary permeability (in this case due to fracturing) which favoured the migration of mineralising fluids.

On the north flank of Calcite Hill the mineralisation is hosted in volcaniclastic rocks and in the lower portion of the overlying calcareous mudstone unit, and in the contact between the same volcaniclastic unit with the lower latite with xenoliths. The entire sequence exhibits structural disturbance. This is attributed to a possible low-angle fault at the base of the sequence which has underlying it the reddish-coloured volcaniclastic basal unit.

The mineralisation occurs principally as veinlets and as matrix filling in the breccia, at times with silica and iron oxides, with minor galena, copper oxides, and scarce pyrite. The upper sedimentary units as well as the volcanic and volcaniclastic units host Ag, Pb, and scarce Cu and Zn mineralisation.

Mineralisation at Calcite Hill forms an irregular body with a narrow upper portion outcropping towards the western end of Calcite Hill, which merges with a larger mineralised lens. Mineralisation outcrops and extends to a depth of around 250 m below surface. It forms a relatively flat surface 600 m long, ranging from 270 m to 600 m in width. The lower portion of the body has an irregular shape resulting from two nearly separate lenses that merge into one lens having a variable thickness between 150 m to 20 m. The body plunges to the southwest with a -5° dip.

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Figure 9.2 Plan of Calcite Hill

9.3 Navidad Hill

A plan of Navidad Hill is shown in Figure 9.3. The Navidad Hill deposit exhibits two different types of mineralisation and control. The first of these outcrops along the crest of the hill where mineralisation related to structural control is most evidently displayed compared to elsewhere on the Project. Here outcropping vein structures exhibit breccias comprised of finely banded crystalline calcite gangue, barite, and finely crystalline to chalcedonic silica. Visually identifiable ore grade minerals include galena, black sulphides, copper and manganese oxides, and lesser quantities of pyrite, chalcopyrite, and rare native copper and silver.

The high grade brecciated vein structures occur in a belt approximately 100 m in width with discontinuous sub-vertical extensions, striking generally at an oblique angle to the main Navidad Trend in the range of 310º to 345º. Vein thicknesses are 1 m or less with Ag values in the 1,000 g/t to 10,000 g/t range. Vein development discontinuity is also evidenced by “rosario” outcrops along strike and by changes in mineralogical composition along strike as well as at depth. The latite wall rock adjacent to the breccia veins is also found mineralised with the development of veinlets, stockworks, and breccia zones. As indicated so far by drilling, the outcropping breccia veins do not extend to a depth exceeding 80 m where the vein integrity tends to break down into a zone of veinlets comprised principally of chalcedonic silica that increases at depth. To date the base of the latite has not been encountered by drilling at Navidad Hill which leaves open the possibility of a dome structure in this area.

The second main type of mineralisation at Navidad Hill is found emplaced on the southwest flank of the hill where it is hosted in and above the contact between the latite unit and an overlying volcaniclastic breccia. It has a well-developed stratigraphic control with a gentle southerly dip of some 20º to 30º. Moving away from the possible dome, the stratiform body changes its composition from a heterolithic latite breccia to a breccia with remobilised sedimentary clasts. This breccia exhibits gangue mineral matrix fillings of calcite, barite, and lesser silica, accompanied by black sulphides, minor galena, copper oxides, and relatively frequent native silver.

A third sub-set of mineralisation is found to the northwest of Navidad Hill where there is found a multi-phase heterolithic breccia with characteristics that indicate an explosive origin. The gangue is principally calcite and barite with ore minerals of galena, possible black sulphides, copper oxides, and contains moderate concentrations of Ag on the order of 100 g/t.

Mineralisation at Navidad Hill trends for 520 m towards the northwest and forms an irregular globular shape ranging from 270 m to 470 m wide and 10 m to 175 m thick. The mineralised zone has a shallow dip to the southwest and lies at the subsurface along the ridge crest to around 50 m depth along the southern flank.

Figure 9.3 Plan of Navidad Hill

9.4 Connector Zone

A plan and cross section of the Connector Zone is shown in Figure 9.. The mineralisation occurs as disseminations and replacement of the matrix in the volcaniclastic rocks. Locally the volcaniclastic rock is crackle brecciated with a matrix of hydrothermal minerals, sulphides and rare native silver. The volcaniclastic rock can exhibit a wide range of textures ranging from conglomeratic horizons to thinly bedded strata. The volcaniclastic unit contains sub-rounded to very angular clasts of latite derived from the uplift and erosion of the latite lavas. Lesser, and generally lower grade mineralisation can also be hosted in the underlying greywacke and the overlaying mudstones.

The Connector Zone is structurally complex. It shares some of the same structural trends found at Galena Hill located immediately to the southeast. At Connector the principal structural trends are:

— North-northeast to south-southwest trending steeply dipping structures that are responsible for radical changes in the stratigraphy across the generalised northwest trending strike of the mineralisation. It is interpreted that displacements along these structures are responsible for changes in thickness of the host volcaniclastic unit of up to 170 m in only 50 m along strike with

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similar changes in thickness in adjoining units. Synchronous erosion is a possible cause of the local removal of both the lower and upper latite lavas that allowed the volcaniclastic and mudstone units to be deposited directly on the lower andesites.

— Northwest to southeast to east-west oriented sub-vertical faulting is interpreted to have followed the deposition of the mudstones and produced a series of horst and graben structures by block faulting similar to those described at Galena Hill. Also similar to Galena Hill are the spatial coincidence of the higher grade values with these structures. It is believed movement on these northwest to southeast structures is synchronous to post-mineral in age.

— The post-mineral, northwest to southeast trending, southwest shallow dipping Sauzal Fault. This structure truncated the host lithologies and mineralisation at Connector Zone in a similar fashion as described at Galena Hill.

— Possible re-activated faulting on the north-northwest to south-southeast trend: Crossing the central portion of the Connector Zone there is some evidence to suggest the presence of a north-northwest to south-southeast trending structural corridor that may have cut and displaced the Sauzal Fault trace.

The mineralisation at Connector forms two intersecting, but distinct bodies, which combined, are 670 m in strike length, and between 240 m and 590 m wide. The mineralisation lies from the surface to a depth of 330 m. The deposits are hosted in a sedimentary sequence comprised of sandstones and fine conglomerates with minor mudstones, interbedded with volcaniclastic layers which are mostly formed by sub-rounded to angular latite fragments derived from the erosion of the latite lavas. Locally the host rocks exhibit micro-veinlets up to 1 cm thick and poorly developed stockwork texture. The intensity of the brecciation is weak to moderate and the gangue infilling is comprised of calcite and silica. Alteration is weak and is manifested by a moderate bleaching of the rock due to the presence of low-temperature illitic-smectitic clays.

Sulphide mineralisation occurs as galena, black and grey presumably Ag-bearing sulphides, as chalcopyrite and bornite disseminated in the sediments, in veinlets, and in replacements in the matrix of the volcaniclastic unit. Native silver is also present in trace amounts.

Of less importance and restricted to the east of the Connector Zone, the mineralisation is hosted by the brittle upper latite and andesite units. Disseminated sulphides occur in hydrothermal crackle breccias with a matrix of calcite and barite with minor laumontite and silica.

In the upper portion of the volcaniclastic unit the geochemical signature is Ag-Pb with minor Cu, and in the lower portion of the sedimentary units Ag is present with practically no lead.

The geometry of the mineralisation suggests the north-northeast to south-southwest structures could be feeder zones for the ascending hydrothermal fluids. The fluids are postulated to have ascended the steep north-northeast structures, and then preceded up dip along the porous volcaniclastic unit where they are intersected by the west-northwest to east-southeast trending block faults.

Figure 9.4 Plan and cross section of Connector Zone

9.5 Galena Hill

A plan and cross section of Galena Hill is shown in Figure 9.. Mineralisation at Galena Hill is hosted in a variety of distinct fragmental rock types. These include hyaloclastites at the margins and ends of lava flows and crackle breccias within the massive cores of the flows. Also present are dikes and pipes of hydrothermal breccia. The predominant style of mineralisation is the selective replacement of breccia matrix, or as open space filling. Locally the mineralisation pervasively replaces the matrix of the host lithologies including the mudstones. Where the mudstones are mineralised, they can form massive sulphide-rich stratiform lenses containing galena and marcasite.

The lithology that hosts mineralisation varies within the different portions of the deposit. At the far northwest end of the deposit the mineralisation is primarily hosted within the lower latite with minor mineralisation in the overlaying mudstones and underlying volcaniclastics. Towards the southeast end of the deposit the mineralisation is hosted in both the lower latite unit and the upper latite unit and locally in the overlaying mudstones. To the far southeast end of the deposit all of the mineralisation is contained within the upper latite with only trace mineralisation contained in the overlaying mudstones.

At Galena Hill both the upper and lower latite lavas are believed to have been emplaced as submarine flows. Evidence supporting this interpretation is the lack of thermal oxidation, which is common in other zones such as Loma de La Plata, and the abundance of very angular fragmental portions of the latite interpreted to represent in situ the reworked hyaloclastite. These fragmental portions of the lava flows are often the preferred location of mineral deposition.

Galena Hill is structurally complex. It is believed to be located at the vertices of several intersecting structural trends. From the reconstruction of the geology it appears that the earliest faults were syn- to post-mineralisation northwest to southeast block faults. Movement on these structures resulted in the formation of a horst and graben geometry. This movement is post-sedimentation, potentially in part syn-mineralisation and definitely part post-mineralisation. The continued movement of these structures post-mineralisation resulted in the uplift and erosion of part of the mineralisation and the preservation of those parts that were down-dropped.

The northwest to southeast trending block faults are truncated by the shallow dipping, northwest to southeast trending Sauzal Fault. The trace of this fault is coincident with the break in slope along the lower northeast flank of the Navidad Trend. The fault juxtaposes all the upper lithologies and mineralisation against the lower “red bed” volcaniclastics. Movement on this structure is considered post-mineralisation. No evidence has been observed to indicate that this fault served in any way as a channel for the ascending hydrothermal fluids.

The last interpreted faulting at Galena Hill occurred along steeply dipping north-northwest to south-southeast trending structures. These structures form a structural corridor roughly 100 m to 150 m wide that crosses the central portion of the mineralisation. These structures are interpreted from surface mapping, ground magnetic and construction of drill sections. These structures are believed to have off-set the Sauzal Fault plane in places.

Alteration is variable from trace to locally strongly argillic. In general alteration is limited to bleaching of the host volcanic rock in close proximity to the mineralisation.

Sulphide minerals are galena, marcasite, lesser pyrite, scarce chalcopyrite, and occasional bornite. According to a preliminary report by Xstrata Process Support (2007), 85% of the Ag is contained in solid solution within a combination of marcasite and pyrite with 15% in acanthite (Ag2S). The lead occurs as galena (PbS). The mineralisation appears to all occur as sulphides with little oxidation observed as evidenced by fresh galena occurrences found at surface. Gangue mineralogy consists chiefly of calcite and barite with lesser silica.

The extent of mineralisation is long and wide with a strike length of roughly 900 m and a width of between 250 m and 700 m. In section views orientated at 030° to 210°, the mineralised body as defined by values approaching 50 g/t AgEQ forms a roughly strataform body with a slight dip to the southwest. This body resembles an inverted shield with a flat top and a thicker central portion that thins to the margins. On nearly every section the mineralisation is affected by post-mineralisation movement on the northwest to southeast trending block faults resulting is displacements of roughly 10 m to 50 m. Those portions of the mineralisation located above the horst are partly eroded whilst those portions to either side are preserved in their entirety. The mineralised zone ranges from a few metres thick at the extreme margins to over 200 m thick in the central portions of the deposit.

Mineralisation outcrops in several locations including the upper northwest flank and within the window through the mudstones in the area of the structural horst. The top of mineralisation ranges from surface to 200 m below surface with an average depth less than 40 m.

There are 12 drill holes in the Galena Hill sector of the Project that are being monitored on a regular basis for determining the level of the water table. Across the area the top of the water table is at approximately 1,137 m elevation, and is indicated on the cross section in Figure 9.. The majority of the Mineral Resource at Galena Hill lies beneath this level.

Figure 9.5 Plan and cross section of Galena Hill

Galena Hill cross section on local coordinate 51000E view to 300°

9.6 Barite Hill

A plan of Barite Hill is shown in Figure 9.. At Barite Hill two styles of mineralisation are present in distinct stratigraphic units. The first occurrence from surface to depth is a relatively weak Ag-Pb mineralisation with minor Cu and Zn hosted in calcite and lesser barite gangue filling veinlets and breccia matrix within the upper latite unit.

The second style of mineralisation is found in two clastic units below the upper latite flow that is normally found mineralised at the Navidad Project. The units are a sedimentary unit comprised of sandstone and mudstone, and a volcaniclastic unit derived from latite. Mineralisation is interpreted to have been emplaced through the migration of hydrothermal fluids across zones of primary permeability in the sandstones or through zones of secondary permeability through fracturing. This lithology package is bounded on top by a greywacke unit and underneath by fine-grained clastic sediments (mudstones), both of which are interpreted to have relatively low permeability.

Observed mineralisation occurs as a matrix gangue filling of calcite, barite and clays that contains sparse chalcopyrite, black sulphides, and native silver. It is deposited in fine fractures, stockworks and breccias in the mudstones and volcaniclastic rocks, and occurs as disseminations of black sulphides in the sandstones. In areas reporting high Ag assay values, native silver is very common and occurs as pure veinlet fillings up to

5 mm in thickness. The principal geochemical association is Ag with low Cu; in general Pb is scarce.

Mineralisation at Barite Hill forms three lenses. The northern lens is about 230 m long along strike, between 170 m and 430 m wide in the dip direction and between 5 m and 30 m thick. The southwest dip varies between 3° where the body outcrops in the north to 25° in the southwest where the body lies approximately 120 m below surface. The second lens is found towards the southern end of Barite Hill. Its dimensions are approximately 300 m long by 350 m wide with thicknesses ranging from 4 m to 32 m. It occurs at the subsurface on the crest of the ridge and plunges to the southwest.

The third mineralised body, characterised by high Ag values, forms an irregularly shaped mass around 350 m long, between 100 m and 400 m wide, and between 7 m to 100 m thick. It lies between 50 m and 200 m below the second lens in southern Barite Hill and has a dip of 30° to the west-southwest.

Figure 9.6 Plan of Barite Hill

9.7 Loma de La Plata

A plan and cross section for Loma de La Plata is shown in Figure 9.. At Loma de La Plata the stratigraphy consists of basal andesites overlain by greywackes and sandy conglomerates that change laterally to mudstones and arkoses. Autoclastic breccias lay between the lower sedimentary sequence and the volcanic flow units comprised by the two latite units, with and without xenoliths, which are separated by an interbedded sedimentary layer. The sequence is completed by mudstones and fine to very fine sandstones that vary to limestones laterally to the east.

In the west to southwest the sedimentary units are thin or missing due to erosion and the lithology is typically comprised by the latites with and without xenoliths that overlay the andesites. Towards the east the sequence is complete due to down–dropped blocks that are the product of normal faulting with an approximate north-south strike presumably resulting from northwest to southeast orientated compression.

The entire sequence has a 325º strike and dips -20° to -30° to the northeast; the dip tends to flatten somewhat along strike to the northwest.

Mineralisation is hosted primarily in the upper latite unit which outcrops in the southwest part of the deposit area and dips towards the northeast where it has been intercepted up to 300 m below the surface. Drilling in 2008 demonstrated that the mineralisation tends to be enriched in breccia zones associated with north-south normal faults that have a spacing on the order of 70 m to 90 m.

The style of mineralisation is characterised by hydrothermal veinlets up to 3 cm thick and tectonic and crackle breccias developed in the brittle massive portions of the lava flow. Gangue mineralisation is comprised of calcite, laumontite, barite and silica present as a white quartz and occasional amethyst. Textures are massive to crustiform and occasionally botryoidal; bladed calcite replacement textures have been observed.

Mineralisation is comprised of acanthite, native silver, argentite, stromeyerite, silver sulphosalts, galena, chalcopyrite and bornite disseminated in the matrix of the breccias and as rims in veinlets. Chalcopyrite is the only mineral that is also disseminated in the host rock. The acanthite and lesser stromeyerite are the principal silver-bearing sulphide minerals that contain approximately 80% of the reported silver. QEMSCAN analyses performed by Xstrata Process Support (2008) report an average Ag grain size in the range of 6 µm to 20 µm.

Geochemical data indicates a good correlation between Ag and Cu and a moderate correlation between Ag and Pb. Arsenic tends to be concentrated in the upper portion of the main mineralised body in the upper latite as well as in the upper non-mineralised sedimentary package. Antimony is present as isolated occurrences in the upper part of the deposit where it exhibits a low correlation with Ag and Cu. For the most part Zn is concentrated in the sedimentary unit beneath the upper latite where it largely occurs in limestone lenses within the mudstone.

Up to three events of brecciation and veinlet formation have been detected during core logging. The brecciation intensity is moderate to strong in the high grade mineralised zone. Mineralisation is interpreted to have been emplaced by the migration of epithermal fluids through zones of previously formed tectonic and crackle breccias. Alteration is weak and is represented by low temperature clays in the proximity of the mineralisation areas. The alteration clay mineral assemblage indicates the presence of low temperature hydrothermal fluids, and the banded textures, bladed calcite, barite and quartz in-fill, along with the presence of abundant base metals, is characteristic of an intermediate low-sulphidation system.

Two distinct mineralised bodies are present at Loma de La Plata. The main deposit is 850 m long with a north-south strike, between 600 m to 1,200 m wide and 40 m to 50 m thick. It covers a surface area of 74 ha. The second body is considerably lower in grade and is located approximately 60 m beneath the main deposit. It has approximately the same surface area as the upper main body but with an average thickness of only 5 m.

The area with the highest grade mineralisation is located in the central and western side of the upper Loma de La Plata deposit; overburden thickness varies from 0 m to 50 m. The dimensions of the high grade zone are 500 m north-south by 170 m east-west.

The principal objectives of the 2008 drilling programme at Loma de La Plata were to upgrade the Inferred resources to Indicated and to define the limits of potential economic mineralisation. Concerning this latter objective, the deposit was defined in the western and southern sectors, where the outcropping andesite forms a footwall to the deposit, without appreciable change in the 2007 resource perimeter. Here the outcropping mineralised upper latite exhibits crackle breccias that are hydrothermally in-filled by calcite with the presence of malachite, azurite and iron oxides.

To the southeast of the deposit the latite lava flow continues towards the Bajo del Plomo area but with greatly diminished Ag and relatively high Pb values. To the east the deposit was expanded by some 400 m where the mineralised portion of the latite becomes progressively thinner with diminishing Ag values and higher lead. Towards the northeast drilling has confirmed that the deposit is cut off by the Esperanza Fault. Towards the north the 2007 perimeter was expanded 200 m where generally no further significant Ag mineralisation has been encountered despite the presence of the host unit.

In summary, the total mineralised footprint has been increased by 100% with respect to the area defined in 2007. The deposit still has limited potential to expand towards the northwest where the latite as well as the mineralisation continues to Valle La Plata sector, and there remain some restricted possibilities for expansion to the east-southeast.

Figure 9.7 Plan and oblique cross section of Loma de La Plata

Oblique southwest-northeast cross section of Loma de La Plata

9.8 Valle Esperanza

A plan and cross section of Valle Esperanza is shown in Figure 9.8. At Valle Esperanza the main mineralised deposit is emplaced in the upper latite volcanic unit without xenoliths immediately below the contact with the upper carbon-rich sedimentary package comprised of mudstone, sandstone, and greywacke. The latite varies from massive to autobrecciated in the flow top depending on the number of lava flows. The unit is brecciated with a matrix of calcite, with minor laumontite, barite and silica that are present as massive in-filling, sometimes as banded textures. In the brittle massive portions of the flows, the breccias occur as tectonic or crackle breccias that were hydrothermally in-filled. In the autobrecciated zones with abundant amygdaloids, the hydrothermal fluids used the primary porosity in the contacts between fragments to generate the breccia. The intensity of brecciation is moderate and at least two events of brecciation are recognised.

Of less importance, a lower grade mineralisation is hosted in the underlying lower latite with xenoliths that is below the upper latite and overlain by another sedimentary package comprised of mudstones, greywacke and volcaniclastic rocks.

Alteration is weak to locally strongly argillic in breccias. In general alteration is limited to a gentle bleaching of the host volcanic rock in close proximity to the mineralisation.

The predominate style of mineralisation is the disseminated occurrence of black sulphides, native silver, chalcopyrite, malachite, pyrite and galena in the breccia matrix and in veinlets up to 1 cm thick. Locally the mineralisation of chalcopyrite and galena pervasively replaces both the matrix and the host lithologies. The silver shows a very good correlation with copper and low correlation with lead.

QEMSCAN analyses of the float concentrate performed by G&T (2009) determined that almost 90 percent of the silver occurs as acanthite/argentite and about 2% occurs as native silver and alloy.

The same volcanic rocks are exposed at surface along both the Esperanza and Navidad Trends. Valle Esperanza is located in a graben structure and the variation in elevation of the latite is the result of block faulting. The mineralisation has been preserved on the down-dropped blocks.

The graben adjoins the northwest-southeast trending Esperanza Fault that has been interpreted from ground magnetic, surface mapping and drill sections. At Valle Esperanza, there are no outcrops or surface evidence of mineralisation. No evidence has been observed to indicate that the Esperanza Fault served as a channel for the ascending hydrothermal fluids.

Drillhole intersections have traced the two mineralised zones from surface to approximately 400 m below surface. The upper body is about 1,100 m long and between 130 m and 700 m wide. The lower body lies approximately 50 m below the upper deposit, and is 800 m long and between 140 m and 500 m wide. Both bodies range in thickness between 5 m to 30 m.

The mineralised horizon strikes approximately to 290° with a variable northeast dip between -70° to -10°. The dip appears to flatten towards the northeast.

The Valle Esperanza deposit is not fully defined as yet and future work will include drilling along strike to the north-west and south-east and down dip to the north of the presently defined deposit.

Figure 9.8 Plan and cross section of Valle Esperanza

9.9 Additional prospects

9.9.1 Navidad Trend

Marcasite Hill

The Marcasite Hill prospect occurs along the southern extension of the Navidad Trend approximately 1 km southeast of Barite Hill; it was originally identified and drill tested during 2007 based on a strong induced polarisation (IP) and resistivity anomaly. The stratigraphic setting is similar to Barite Hill, but with a thickening of the pelitic sediments below the latite. Structural complexity and widespread fracturing is attributed to a northwest trending regional fault that passes to the east of the hill.

9.9.2 Argenta Trend

The Sector Z, Bajo del Plomo, Filo del Plomo, Ginger, and Yanquetru zones are located along the northwest trending contact between the latite and the overlying upper sedimentary package in the Argenta Trend. Mineralisation is characterised by veinlets and discontinuous breccias in the latite with open-space fillings of calcite, minor barite, and locally important quantities of galena with moderate accompanying Ag.

To date limited drilling has been done at Ginger and at Bajo del Plomo. In the latter area Pb values appear to diminish rapidly at depth below outcrop, suggesting the development of near-surface supergene enrichment. At Ginger, where only one drillhole has been completed, low values in Pb and Ag have been detected in brecciated portions of the latite which may occur only as a lens in this area. At Sector Z, which occurs approximately 2 km to the northwest of Loma de La Plata, copper oxides are observed with only minor Pb present in samples; the geochemical association suggests Ag-Cu. Greater structural complexity, as observed though faulting and folding, is indicated in the Sector Z area.

10 Exploration

Information in this section has been sourced from Snowden (2009), which was excerpted and updated from Williams (2007).

10.1 Exploration by Normandy Mining in 2002

The first exploration programme on the Navidad Project area consisted of a preliminary regional geochemical sampling programme conducted by Normandy in mid 2000 to locate additional deposits to supplement those known at its Calcatreu Project, a gold and silver deposit located approximately 90 km from Navidad. The programme consisted of 1,200 BLEG stream sediment samples taken from drainage systems overlying Jurassic age volcanic rocks in Chubut Province in the general vicinity of Calcatreu, Mina Angela, Gastre, Lagunita Salada, Gan Gan, and other areas. This programme took place on what was then considered open exploration ground, and resulted in the identification of various anomalies, including the Flamingo Prospect and Sacanana, which is today known as Navidad.

10.2 Exploration by IMA from December 2002 to July 2006

10.2.1 Geological mapping and topographical surveys

IMA commenced the initial detailed outcrop mapping of the Navidad Project along the Navidad Trend in 2003 at both 1:500 and 1:5,000 map scales. During 2004 this mapping was expanded to cover a wider portion of the mineral tenement at 1:5,000 and 1:10,000 map scales.

In 2003 IMA produced a 2 m contour map over the central portion of the Navidad Project using a differential GPS. The coverage of this topography is 2.5 km by 4.5 km. Outside this core zone 10 m contour lines were produced from satellite radar data. In 2004 IMA commissioned high resolution air photo coverage of the Navidad Project area. These photos were used to produce an orthophoto of the Project area and to create 2 m contour lines covering an area of 14.4 km by 5.5 km.

10.2.2 Geophysical exploration

In 2003 IMA contracted Proingeo S.A. to conduct a limited ground gravimetric survey over Galena Hill, Connector Zone and the southeast part of Navidad Hill. The survey consisted of ten lines of roughly 2 km each at 200 m line spacing.

In 2005 IMA commissioned Quantec Geoscience Argentina S.A. (Quantec) to conduct pole-dipole and gradient array IP and ground magnetometer surveys over the Navidad Trend. These surveys covered roughly an area of 6.9 km by 4.6 km. A large open spaced survey of IP covered strike extensions of the main trend for a total coverage of 14.4 km by 5.5 km. The data from these surveys was reprocessed in 2007 by Aquiline. The results of these surveys were mixed, probably in great part due to the distinct physical characteristics of the various deposits and their varying degree of oxidation.

10.2.3 Geochemical exploration

Commencing in 2002 and continuing through 2006, IMA collected soil, rock chip and stream silt samples over the Navidad Project. A total of 1,852 rock, 6,411 soil and 63 stream sediment geochemical samples are listed in the IMA database spatially related to the Project area. This work led to the identification of nearly all mineralised bedrock exposures known on the Property. The best example of soil geochemistry leading to the

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identification of a mineralised zone is that of Loma de La Plata. Collectively the anomalous rock chip samples clearly delineate the Navidad, Esperanza and Argenta trends as does the soil geochemistry.

10.2.4 Diamond drilling

A list of the drillholes completed by IMA between November 2003 and July 2006 is shown in Table 10.1.

Table 10.1 Diamond drillholes completed by IMA from 2003 to 2006

Deposit	Number of drillholes	Metres drilled
Calcite NW	45	7,788
Calcite Hill	71	13,949
Navidad Hill	96	11,289
Connector Zone	37	4,712
Galena Hill	66	12,862
Barite Hill	8	1,315
Loma de La Plata	12	1,615
Exploration drillholes elsewhere on the Property	32	7,391
Total	367	60,921

10.2.5 Other work

Metallurgical samples were also collected during IMA's second field season running from November 2003 to March 2004, the results of this test work is summarised in Section 16.

In 2005 Peter Lewis, a consulting structural geologist, studied the Project area including the Esperanza and Navidad trends. He concluded the Esperanza Fault formed part of the larger Gastre Fault system and was active at the time of mineralisation. He postulated that there could be a splay to this fault that was as yet unrecognised coincident with the Navidad Trend and that mineralisation was related to dilatational zones formed by dextral strike-slip movement on these northwest-southeast structures. He further concluded that post mineral tectonic activity resulted in deformation of the host rock units. This manifested in the formation of folds and southwest dipping thrust faulting.

10.2.6 Mineral Resource estimates

In February 2006 and updated in May 2006, Snowden prepared Mineral Resource estimates for IMA on the Navidad Project deposits including Calcite NW, Calcite Hill, Navidad Hill, Connector Zone, and Galena Hill (Snowden, 2006a). In September 2006, Snowden prepared an updated Mineral Resource estimate and drill spacing study at Galena Hill for IMA (Snowden, 2006b).

10.3 Exploration by Aquiline from October 2006 to June 2009

The Qualified Person for exploration at the Navidad Project is Mr. John J. Chulick, who is a registered geologist in the State of California.

Aquiline focussed exploration efforts on identifying new exploration targets with diamond drilling, with delineation and infill drilling at the Loma de La Plata deposit, and with minor infill drilling of other previously identified mineralised zones. Exploration for additional deposits through the use of fence drilling across prospective covered areas is feasible, since as is so far known, the occurrence of the latite unit hosting mineralisation is generally of relatively large areal extent that can be measured in units of tens of hectares. Mineralisation is frequently stratiform with relatively shallow dips, and most of the known deposits occur as large roughly tabular bodies.

Geophysical and geochemical methods have proved useful in mapping the distribution of the latite unit and potassic-style alteration, in detecting Galena Hill style sulphide-rich mineralisation, and in interpreting the Project-scale structural regime. The characteristics of the host rock and wall rock units are favourable for diamond drilling, and extensive areas can be rapidly explored by drilling at relatively low cost. As was demonstrated during the 2007 diamond drilling programme, additional Resources can be delineated by extension drilling laterally away from known deposit areas.

10.3.1 Diamond drilling

A list of the drillholes completed by Aquiline from November 2006 to March 2009 is shown in Table 10.2. A plan of the drillholes completed at the Navidad Project at the time of the April 2009 Mineral Resource estimate is shown in Figure 10.1.

Table 10.2 Diamond drillholes completed by Aquiline from 2006 to March 2009

Deposit	Number of drillholes	Metres drilled
Calcite NW	68	9,144
Calcite Hill	10	1,024
Navidad Hill	8	909

Connector Zone	36	6,994
Galena Hill	26	4,359
Barite Hill	48	11,518
Loma de La Plata	226	46,867
Valle Esperanza	53	20,399
Bajo and Filo del Plomo	22	2,798
Marcasite Hill	14	2,616
Exploration holes elsewhere on the Property	47	12,715
Condemnation holes for tailing dam	25	8,617
Total	583	127,960

Figure 10.1 Plan of drillholes completed at the Navidad Project

10.3.2 Geophysical exploration

Gravity and resistivity geophysical techniques may be valuable tools to map the distribution of the latite unit in the sub-surface or beneath covered areas. IP is an effective geophysical method to detect Galena Hill style sulphide-rich mineralisation even to a considerable depth below the surface. Ground magnetic, and by inference, aeromagnetic geophysical data is seen by staff geologists as an effective technique to aid in the interpretation of the Project-scale structural regime.

Structural interpretation will aid in understanding the distribution of the latite unit as affected by half-graben type faulting and possible thrust fault displacements.

Gravity surveys

Between March and May 2007 Quantec conducted a gravimetric survey over an area measuring approximately 10 km by 8.5 km in the area referred to as the core Navidad Project area. Measurements were recorded at 150 m stations along 82 parallel lines trending 030º located at 200 m intervals. A total of 2,998 grid stations were read in the survey area. Station locations were surveyed with a differential global positioning system (DGPS), ensuring accuracies of ±5 cm. The objective of the survey was to map out density variations that potentially coincide with mineralisation and to provide data for structural interpretation.

Raw data for this survey has been interpreted by geophysical consultant Robert Ellis who has produced a residual Bouguer gravity model over the tested area. In this model the earlier acquired Proingeo data (2003) demonstrates a gravity high in the area of Galena Hill. Other gravity anomalies within the survey area remain to be tested by drilling.

Ground TEM survey

Between January and February 2007 Quantec ran a transient electromagnetic (TEM) survey on three test lines. The tests were performed to determine if a recognisable TEM response could be observed across areas of known mineralisation and in particular across massive sulphide mineralisation beneath Galena Hill. Each line was surveyed with transmitter 200 m by 200 m loops advanced at 50 m intervals, and then repeated with 100 m by 100 m loops advanced at 25 m intervals. The reading instrument was a Zonge GDP-16 receiver. Results were “flat” and no meaningful TEM response was detected.

Ground SP survey

A self-potential (SP) test was carried out during the same period as the TEM survey. The purpose of the SP test was to map naturally occurring voltage patterns produced by the oxidation of sulphides. Three 4,200 m test lines were selected to transverse known mineralised areas. Three averaged measurements were taken at 25 m intervals along the test lines. Results were considered to be too ambiguous to justify continuing with this method as a geophysical prospecting technique at Navidad.

Ground radiometric surveys

Ground radiometric testing was done with an Exploranium Gamma Ray Spectrometer GR 256 during the same period as the TEM survey and across the same three lines used for the SP test. The purpose was to determine if alteration related to mineral occurrence, particularly the introduction of potassium in the form of adularia, gives a coherent radiometric signature. Thirty-second measurements were taken at 25 m intervals on the test lines. Results for potassium were considered to be sufficiently correlative with areas of known mineralisation to justify radiometric measurements in the fixed-wing geophysical survey conducted in 2008.

Fixed-wing magnetometer and radiometric surveys

In 2008 a 9,700 line-km fixed-wing geophysical survey collected magnetic and radiometric data over 1,935 km2 of selected Aquiline controlled mineral tenements in Chubut province. The survey was flown using 200 m line spacing and 2 km tie-lines spacing. The survey consisted of a northern and southern block. The northern block covered 1,670 km2 and was designed to include all of the Cañadón Asfalto Formation on strike with the Navidad Project. The southern survey block covered 265 km2 including a basin containing Cañadón Asfalto Formation sediments. These surveys are helping build ongoing regional exploration activities.

High resolution ground magnetometer surveys

During the last quarter of 2008 a 2,153 line-km high definition ground magnetometer survey was conducted over the entire Navidad Project area. The survey covered a surface area of 10,750 ha. Five roving magnetometers on 50 m line spacing were used to collect readings at one second intervals. Line orientation of the main survey was 030˚. Two smaller surveys using 300˚ line orientations were conducted over the Navidad

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Trend and Loma de La Plata. Combined these surveys greatly aided in the definition of boundaries of magnetic rock units and identify structures that juxtapose rocks of different magnetic susceptibilities.

Ground 200 m dipole and CSAMT surveys

During 2008 seven test lines for a total of 53 line-km of deep looking IP and CSAMT were conducted by Quantec over the Navidad Project area. The objective of these surveys was to provide information from depth for both the extension of mineralisation and to better understand the structural architecture of the geology.

10.3.3 Geochemical exploration

A series of orientation geochemical surveys were conducted by Aquiline over known mineralised zones on the Navidad Project in early 2007. These included soil, stream silt and biogeochemical surveys. As a result new sampling protocols were established that markedly improved the geochemical response in both ore and path finder elements. The biogeochemical study provided distinct and complementary information to that of the soil geochemistry. This has led to the protocol of collecting twin biogeochemistry and soil geochemistry samples. The greater sensitivity of the new sampling protocols has allowed the initial phase of sampling to utilise a wider spacing on grids while maintaining good line to line correlation.

From the end of 2007 and into 2008 a large combined soil and biogeochemical survey was conducted over the Navidad Project area and the projected on-strike extensions of the zone under Quaternary cover. A total of 3,316 soil and 4,297 biogeochemical samples were collected. Results of the surveys have identified new zones of precious and path finder base metals that are being followed up by reconnaissance drill programs. The geochemical data is also being incorporated into the environmental base line studies.

10.3.4 Geological mapping

Beginning at the end of 2007 Aquiline geologists have conducted a programme of re-mapping and expanding the coverage of geologic mapping of the Navidad district. Currently 240 km2 are mapped covering the entire Navidad Project and surrounding area. The main objective of this work is to improve the geological understanding of the geology and controls to mineralisation. This is being done by refining the Project stratigraphy and establishing the location, relative sense of movement and timing of the complex structural elements. This work has led to an updated deposit model as discussed in detail under Section 8 of this report.

10.3.5 Mineral Resource estimates

In November 2007, Snowden prepared an updated Mineral Resource estimate for Aquiline for the Barite Hill, Galena Hill, Connector Zone, Navidad Hill, Calcite Hill, Calcite NW, and Loma de La Plata deposits. The November 2007 Mineral Resource estimates have been superseded by the April 2009 estimate.

10.3.6 Future exploration work

Continued exploration in the company's land package in the Navidad district will be directed towards additional Jurassic-age basins in the Gastre structural corridor with Cañadón Asfalto lithologies. Geochemical sampling techniques should be effective tools to efficiently explore these basins. The distribution of associated potassic-style alteration such as adularia within the regional basins may be detected through the interpretation of the 2008 airborne radiometric survey.

Approximately US$500,000 was expended per month in Argentina on the exploration programme and related activities for the Navidad Property in 2009. Pan American will continue exploration drilling on several open or new targets along the mineralised trends. Infill drilling is planned for Loma de la Plata, Valle Esperanza, Barite Hill, and Galena Hill during 2010. These drillholes will also provide new samples for metallurgical analysis. Additional condemnation and geotechnical drilling is planned for potential future infrastructure sites.

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11 Drilling

Information in this section has been sourced from Snowden (2009), which was excerpted and updated from Kain (2007). The Qualified Person for drilling at the Navidad Project is Mr. John J. Chulick.

11.1 Diamond drilling methods

All diamond drilling on the Navidad Project since the first drillhole in November 2003 has been completed by Boart Longyear Connors Argentina S.A. of Mendoza, Argentina (subsequently taken over by Boart Longyear in 2007). One rig is employed on a discontinuous basis and is capable of drilling deeper than 400 m with HQ sized rods. Nearly all holes have been drilled at HQ3 diameter (61 mm) with 3 m long rods, except for rare instances where the drillhole was collared at HQ size diameter and subsequently reduced to NQ diameter down the drillhole. No liners or split-tube core barrels have been used in the drilling process. Frequently used drilling additives include Polyplus, Platinum Lube, and G-Stop. Common rod grease may be used for exceptionally deep holes. Drilling conditions are very good with drilling rates of approximately 120 m per day per machine. During 2008, up to three additional drill rigs operated on the Project: one continued with exploration drilling; the other two rigs were dedicated to a programme of in-fill and extensional drilling and orientated-core drilling in support of a geotechnical study of the Loma de La Plata deposit. One of the Loma de La Plata drill rigs was swapped for a period of time with a rig capable of drilling PQ3 diameter (83 mm) drill core for metallurgical sampling. The holes for metallurgical sampling doubled as in-fill drillholes. Split-tube core barrels were used during the orientated core drilling of Loma de La Plata for geotechnical analysis.

11.2 Drillhole collar surveys

Staff geologists set up drill collars in the field by locating the planned collar coordinates with a GPS unit or occasionally by tape measure from a nearby drillhole. The geologist aligns the azimuth of the rig by setting out a row of stakes oriented on the desired azimuth, frequently 030°, with a Brunton compass. The edge of the drill rig, such as the Nodwell track or the outer wall of the mounted housing unit, is aligned with the stakes.

Drillhole inclination is set by placing the inclinometer of the Brunton compass directly on the drill rod.

After drilling the hole, collar coordinates are periodically surveyed by a professional contract surveyor using total station methods or more recently with a differential GPS. The survey point of reference is a federal government geocentric reference frame (POSGAR) point. Coordinates are expressed in the Gauss Kruger Zone II system, relative to the Campo Inchauspe datum. Drillhole azimuths at the Navidad Project have historically used a magnetic declination correction of 08°E, but beginning in 2009 drillholes from number NV-949 onwards will use an updated correction of 06.5°E.

11.3 Downhole surveys

A number of different instruments have been employed at the Project to define the drillhole trace down the hole (Table 11.1). Aquiline previously used a system of taking downhole surveys either halfway downhole, or every third of the hole, or every quarter of the hole, depending on hole length. In October 2008 Aquiline implemented a system of standardising downhole surveys every 50 m, and beginning in 2009, in deposits where resources have previously been estimated, downhole readings are now taken at 30 m intervals. Currently no downhole survey of the bearing and dip is taken at the collar, but the first measurement is now taken not lower than 10 m below the drill collar. No surveys are taken of vertical holes. Snowden recommends that Pan American survey all drill holes regardless of their orientation with the first measurement taken at the collar of the hole.

The average distance between downhole surveys is 84 m between surveys, with a maximum distance of 232 m. Beginning with drillhole 616, survey measurements have averaged 52 m between readings. No serious drillhole deviation problems have been encountered in the drilling to date. Azimuth swing between downhole surveys ranges between 0° and 10°, with lifts of between 0° and 3°.

Table 11.1 Downhole survey methods at the Navidad Project

Date	Drillhole numbers	Method
November 2003 to June 2004	1 to 72	Tropari
July 2004 to April 2007	73 to 445	Sperry Sun
April 2007 to present	446 onwards	Reflex EZ-shot

11.4 Drill intercepts

Drill intercepts are given for prospects at the Navidad Project which are not included as part of the 2009 Mineral Resources.

11.4.1 Southern Argenta Trend (Yanquetru)

Several holes were drilled in the Yanquetru area to test at depth the Pb mineralisation observed in soil anomalies. Drillhole NV07-409 intersected a zone within the sediments from 106.3 m to 166.3 m that averaged 0.5% Zn over 57 m. From 187.3 m to 193.3 m, the drillhole intercepted 6 m averaging 21 g/t Ag and 0.2% Pb in the rhythmically bedded turbidite-like greywacke below a 7 m thick horizon of latite. This mineralisation is interpreted to represent a lower grade, relatively zinc-rich distal zone of mineralisation lateral to the higher grade core deposits.

11.4.2 Marcasite Hill

Marcasite Hill is located at the southeast end of the Navidad Trend as it is presently known, approximately 1 km to the southeast of Barite Hill. It initially attracted attention due to a sharp IP response, and outcrop examination revealed veinlets and breccia with calcite, galena, and marcasite mineralisation, hosted in the upper latite unit. To date Marcasite Hill has been tested by 14 drill holes, NV07-435 through NV07-600, which are located in an irregular area of approximately 850 m by 450 m though the majority of the holes have been drilled in an area measuring 300 m by 200 m.

Beneath the latite, sedimentary units are encountered comprised principally by mudstone and lesser sandstones and sandy conglomerates that are similarly mineralised by calcite, galena, and marcasite/pyrite occurring in breccia and veinlets. The most noteworthy hole drilled in this sequence is NV07-596 with an intercept of 104 m at 0.42% Pb, 0.55% Zn, and low grade anomalies in Ag to 12 g/t with an average of 3 g/t Ag.

11.4.3 Bajo del Plomo and Filo del Plomo

To date 20 holes have been drilled in the Bajo del Plomo and Filo del Plomo prospects along the Argenta Trend for a strike length of 1,400 m and down dip from the crest for approximately 400 m. It is believed that the total down-dip extension could be on the order of 600 m or more based on the continuation of this mineralisation in the so-called Tailings Dam area. The mineralisation is hosted in the upper latite, with an attitude of azimuth 315º dipping 20° northeast, and along the contact with the overlying sedimentary units where these are preserved. The mineralisation in the latite unit is found as irregular breccia fillings or in veinlets and typically consists of calcite, galena, and lesser barite. In general analytical results report high lead values with low silver. The most significant intercepts are found in hole NV07-486 for 13.15 m at 97 g/t Ag and 7.10% Pb, hole NV07-494 for 12.5 m at 72 g/t Ag and 1.30% Pb, and in hole NV07-644 for 13.4 m at 40 g/t Ag and 2.53% Pb.

11.4.4 Tailings Dam

In this area 26 holes were completed to evaluate the area proposed in the Preliminary Economic Assessment study as a site for a future tailings dam, hence this was in large measure a condemnation drilling programme. The holes were typically drilled to a depth of 300 m. They frequently terminated in mudstone, but several holes managed to intercept the upper latite unit which in several cases reported mineralisation of the style encountered at Filo del Plomo. The most noteworthy intercepts were found in hole NV08-695 for 4.80 m at 25 g/t Ag and 2.70% Pb, hole NV08-796 for 9.0m at 18 g/t Ag and 1.18% Pb, and in hole NV08-842 for 22.0 m at 32 g/t Ag and 0.63% Pb, with values up to 149 g/t Ag.

11.4.5 Sector Z and Valle La Plata

Sector Z is a hilly and structurally complex area at the northwest extreme of the Argenta Trend; to date it has been tested with 11 drill holes in two sub-areas. At Valle La Plata, between the Loma de La Plata deposit and Sector Z, seven holes have been drilled with generally wide spacing of 200 m to 300 m between collars. To date neither zone has demonstrated continuous significant mineralisation though several individual intercepts have been noteworthy. The most significant intercepts in Sector Z include hole NV08-670 for 14.70 m at 73 g/t Ag and 0.34% Pb, hole NV08-742 for 10.97m at 47 g/t Ag and 0.24% Pb.

The majority of the holes drilled in the Valle La Plata zone have cut short intervals with anomalous to moderately significant Ag mineralisation in the upper latite unit. The most noteworthy intercepts include hole NV08-751 for 6.82 m at 105 g/t Ag and 0% Pb and hole NV08-760 for 4.0 m at 80 g/t Ag and 0% Pb.

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12 Sampling method and approach

The sampling method at the Navidad Project has followed similar protocols for the life of the Project. The Qualified Person for the sampling method and approach at the Navidad Project is Mr. John. J. Chulick.

12.1 Core logging

Aquiline followed the same sampling methodology for diamond drill core sampling at Navidad since acquiring the Project from IMA, with a few refinements. Approximately five staff geologists are responsible for logging drill core, which takes place at the core logging facilities in Gastre. Drill core from NV07-459 onwards are stored in Gastre, along with core selected as representative of each deposit (NV05-241 to NV05-245, NV06-278, NV06-324, NV06-343, NV06-363, NV06-372, NV06-379, NV06-403, NV07-442, and NV07-449). Drill core up to NV07-458 is stored in Gan Gan, except the representative drillholes stored in Gastre.

Drill core is stored and well maintained in wooden core boxes with a nominal capacity of approximately 3 m. The drillhole number, box number, and downhole interval are marked in felt tip marker on the side of the box. Wooden downhole core depth markers are placed in the core box by the driller indicating the drillhole number and end of run depth.

Staff geologists log the drill core in detail using standardised logging sheets on handheld computers for: lithology; alteration type, style, and intensity; mineralisation type, style, and intensity; and structural information. The entire drillhole is photographed prior to cutting. Geotechnical information including drill core recovery, RQD, weathering, texture, fracture frequency, type, roughness, infill, shape and angle, hardness, and other notes are recorded on a drill-run basis.

12.2 Sampling

Samples are taken continuously downhole within the prospective lithologies, along geological boundaries rather than by a pre-determined length, which represents best practice. Samples within geological similar units are selected at 3 m intervals. Samples are marked for cutting by indicating the sample interval with a yellow paint marker and stapling a waterproof sample number tag on the core box. The drill core is cut in half with a diamond bladed core saw, using recycled water decanted from a settling tank. There is evidence that core samples are not always cleaned subsequent to cutting. Wherever the drill core is too broken for cutting, samples are selected by hand or with a spatula, and very rarely a mechanical splitter is used for core intervals too small for cutting with the saw.

Samples are collected by staff, placed into a previously numbered plastic bag along with a waterproof sample number tag indicating the sample depth interval and the sample number corresponding to the tag stapled to the core box. The plastic sample bag and tag are then sealed with a tamper-proof plastic tie embossed with the sample number.

Several sample bags are then placed into larger poly-woven plastic bags, weighed, and transported to the Alex Stewart Mendoza sample preparation facility by drivers from the Gastre community or by staff.

The remaining drill core is stored under cover at Pan American's core storage facilities in Gastre and Gan Gan.

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12.3 Density determinations

Density determinations are made on a box by box basis for the entire drillhole. Technicians record the downhole interval marked on the box and the length of the sample contained within the box to obtain the recovery percentage. The volume of the sample is calculated by multiplying the core diameter (6.1 cm) by the recovered core length. The density is then calculated by weighing the core box, subtracting the weight of the wooden core box (previously set at 3,580 g, but now set at the average weight of each new shipment of boxes), and dividing by the volume of the recovered sample. Boxes with more than 15% core loss are excluded from the database.

There are a number of potential sources of error when determining density values using this method, including the accuracy of the scale in use, the accuracy of the drill core recovery estimation, using a set weight for a wooden core box, and the crossing of lithological and/or mineralisation boundaries within the core box. Snowden (2007) made recommendations for more reliable methods for determining density values.

Since October 2008 drillholes numbered NV08-876 and above have had their density determined using the water displacement method, in addition to the box method. Older drillholes under examination have also had density determinations made using the water displacement method. An approximately 20 cm long piece of competent core is selected, quartered with a saw, washed, and dried on a hot plate for between five and ten minutes. The weight of the dry sample is recorded, and the sample is suspended on a length of string and completely submerged into a 1,000 ml capacity cylinder containing 600 ml of water. The displaced water volume is recorded, and the density is calculated by dividing the volume of the displaced water by the weight of the dry sample.

Snowden considers that this methodology may also introduce error in the density determination due to the relatively small size of the sample and the potential introduction of water in porous samples. Snowden recommends that Pan American select whole core samples and coat the entire sample with wax or varnish to prevent the sample from retaining water.

12.4 Independent statement on sampling methods

Snowden are of the opinion that drillhole logging and sampling procedures used by Pan American could conform to standard industry practice by following the recommendations outlined in Section 12.5.

Snowden was not able to verify historical drilling and sampling practices.

12.5 Recommendations

Snowden recommends the implementation of the following practices to improve the quality of the sampling data:

- Determine the density of drill core prior to splitting with the diamond saw. Samples should be coated to prevent water retention. Specific gravity samples should be selected according to a representative suite of lithologies, mineralisation, and alteration types, through spatially representative locations throughout the area covered by drilling.
- Discontinue the practice of using recycled water during core cutting and rinse the cut samples prior to sampling, to prevent the risk of cross-contamination.

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13 Sample preparation, analyses, and security

Information in this section has been sourced from Snowden (2009).

The Qualified Person for the sample preparation, analyses, and security at the Navidad Project is Mr. John J. Chulick.

13.1 Sample preparation, analyses, and security

13.1.1 Laboratory

All diamond drill core samples at the Navidad Project have been analysed by Alex Stewart Assayers Argentina S.A. (Alex Stewart) of Mendoza, Argentina. Alex Stewart is ISO 9001:2000 accredited for the preparation and chemical analysis of mining exploration samples. On two separate occasions in 2003 and 2007, Smee and Associates conducted a laboratory inspection and considered the laboratory to conform to industry best practice methods for analysis (Smee, 2003 and Smee, 2007).

13.1.2 Sample preparation

Upon receipt of the sample submission, each sample bag is weighed and the entire sample is removed from the bag and placed in a drying pan. Samples are dried at 70°C for up to 40 hours.

After drying, the entire sample is removed from the drying pan and jaw crushed to #10 mesh to reduce its fragment size so that 95% of the sample is less than 2 mm in size (which is monitored by subsequent screen tests). The entire sample is passed through a riffle splitter several times before a final split of 1.2 kg is collected.

At this point a 1.2 kg duplicate of the course reject is collected randomly from each analytical batch. This coarse reject duplicate is subsequently re-numbered as the original sample number with the suffix “DC” and then treated as a normal sample. The residual coarse reject is stored.

The sample is then pulverised ensuring that at least 80% of the material is less than 75 µm in size (80% passing through #200 mesh, also monitored by screen tests). A representative 250 g split of the sample pulp is taken as the sample and pulp duplicates are routinely collected by the laboratory and assayed as part of their analytical quality control measures. The remaining pulp reject (approximately 950 g) is stored for future reference.

The crusher and pulveriser are cleaned with barren quartz between each sample.

13.1.3 Sample analyses

All drill core samples at the Navidad Project have been analysed by fire assay for silver with gravimetric finish and gold for AAS finish and ICP-ES for 19 elements using the ICP ORE technique.

For Ag fire assay, a 30 g charge is fused with 230 g of flux in a furnace with temperature control at 1,050°C to produce lead buttons with a weight of at least 30 g. The lead buttons are weighed and any sample with a button less than 30 g is repeated. The cupellation of the lead buttons occurs in a furnace with temperature control at 950°C. Two standards of pure metallic silver are included in each cupellation batch to quantify the Ag loss during the process. The prills are weighed in a microbalance and Ag dissolved with HNO3 and Au with Aqua Regia.

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Gold content is determined by AAS and the silver value is calculated as the difference between the weight of the AAS Au and Ag. The final Ag value considers Ag lost by cupellation and adds Ag based on the two metallic silver standards. Silver detection limits are 2 g/t Ag and occasionally 1 g/t Ag.

In addition, all samples are also analysed by the ICP-ORE technique that uses strong multi-acid digestion on a sample size of 0.2 g with concentrations determined by ICP-ES. The method uses a very strong oxidising attack to ensure the complete dissolution of sulphides and has been optimised to handle a wide range of concentrations of base and other metals, but with higher than normal detection limits for typical ICP analyses. The sample is dissolved with NPC (3% potassium chlorate in HNO3), HBr and HCl. The elements included in the package are Ag, As, Bi, Ca, Cd, Co, Cu, Fe, Hg, Mg, Mn, Mo, Ni, P, Pb, S, Sb, Ti, and Zn. The detection limits for silver, lead, copper, and zinc are 5 ppm Ag, 0.01% Pb, 0.005% Cu, and 0.01% Zn.

The QC protocol employed by Alex Stewart consists in batches of 50 samples for fire assay and up to 100 samples for ICP. Fire assay batches include one preparation blank, one analytical blank, one coarse duplicate, four pulp duplicates, one international certified standard for base metal and silver, one uncertified in-house standard, and two standards made from pure silver to calibrate losses in cupellation. ICP batches include two blanks, four standards, and 10% duplicates.

13.1.4 Sample security and chain of custody

Samples are transported from the drill rig to storage facilities in Gastre by staff, where a staff geologist logs and photographs the drill core. Drill core is cut and sampled by a staff technician, placed in a plastic bag and sealed with a numbered tamper-proof tag corresponding to the sample number. Five to six samples are placed in a large nylon-woven sack which is then also sealed with a tamper-proof nylon tie. The sack, generally containing about 50 kg of samples, is weighed by a staff technician and transported by staff or a member of the local community to the Alex Stewart sample preparation facilities in Mendoza, where each individual sample is maintained under the control of Alex Stewart. After sample preparation and analyses are complete, all pulps and coarse rejects are shipped by Alex Stewart to a covered warehouse facility rented in Mendoza, where the samples are stored permanently.

13.1.5 Independent statement on sample preparation, analyses, and security

Snowden are of the opinion that sample preparation, analyses, and security of diamond drill core samples for the Navidad Project are of industry standard and are suitable for use in Mineral Resource estimates.

13.2 Quality control measures

Aquiline routinely inserted certified standards, blanks, and field duplicates with sample submissions as part of their sample assay quality assurance/quality control (QAQC) programme, and provided Snowden with the data for review. Analysis of QAQC data is made to assess the reliability of sample assay data and the confidence in the data used for the resource estimation.

13.2.1 Certified standard samples

Certified standard samples are used to measure the accuracy of analytical processes and are composed of material that has been thoroughly analysed to accurately determine its grade within known error limits. A standard is considered to have failed if the assay result is above or below three standard deviations of the mean certified standard value defined by the standard manufacturer. If a standard has failed then it may be necessary to re-analyse the sample batch associated with the standard.

A total of 3,734 standard samples have been submitted at a frequency of 1 in every 21 samples. Aquiline used standards for Ag and Pb comprised of material collected from site and prepared by Acme laboratories in Santiago, Chile, ALS Chemex in La Serena, Chile, ALS Chemex in Vancouver, Canada, and Assayers Canada in Vancouver. The list of standards employed by Aquiline and used to assess the quality of assays used in the April 2009 Mineral Resource estimate is presented in Table 13.1. Not all standards have been certified for Cu.

By late 2008 these standards had been depleted, and Aquiline purchased three new standards certified for Ag, Pb, Cu, and Zn, prepared and packaged by CDN Labs of Delta, British Columbia. The standards have been certified by seven laboratories including Alex Stewart of Mendoza, ALS Chemex of Vancouver, Acme of Vancouver, Acme of Santiago, SGS of Lima, ALS Chemex of La Serena, and G&T Metallurgical of Kamloops. Only three standards had been submitted at the time of the April 2009 Mineral Resource estimate, therefore no analysis has been made of their results.

Table 13.1 Certified values of standards

Standard	Certified mean grade by FA-GRAV (g/t Ag)	Standard deviation by FA-GRAV (g/t Ag)	Certified mean grade by ICP-OES (% Pb)	Standard deviation by ICP-OES (% Pb)	Certified mean grade by ICP-OES (% Cu)	Standard deviation by ICP-OES (% Cu)
GMB01	110.62	3.28	6.73	0.13	0.011	0.0029
LGH	67.61	2.85	2.26	0.04	-	-
MGH	230.96	5.87	4.54	0.09	-	-

NHBG01	6940.2	166.11	14.52	0.58	6.24	0.103

Standard GMB01

1,062 samples of low grade standard GMB01 were submitted from 2003 until 2008. The results from the silver gravimetric methods are shown in Figure 13.1 and have a good accuracy. Copper ICP data results are also good, while lead ICP data exhibit a slightly high bias, which is not considered significant.

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Figure 13.1 Low grade standard GMB01 results

Low grade standard GMB01 by FA-GRAV for Ag

Low grade standard GMB01 by ICP-OES for Pb

Low grade standard GMB01 by ICP-OES for Cu

Standard LGH

Standard LGH was used by Aquiline in August 2007 to replace standard GMB01. A total of 849 LGH reference samples were analysed (Figure 13.2). Ag results from FA-GRAV analyses are well constrained about the mean certified value. Pb results are more scattered but most results are within tolerance limits. 24 standard samples failed for Pb, representing approximately 3% of the samples analysed between May 2007 and December 2008. A high bias (on average) approximately equal to one standard deviation above the mean certified value is present (approximately 1%). The bias does not appear to be a cause for concern; however, Pan American is recommended to follow up on any failed standard samples with the laboratory.

Figure 13.2 Low grade standard LGH results

Low grade standard LGH by FA-GRAV for Ag

Low grade standard LGH by ICP-OES for Pb

Standard MGH

Aquiline began using the medium grade standard MGH in January 2007. A total of 977 MGH reference samples were analysed over a period from January 2007 until January 2009 (Figure 13.3). Analyses of Ag standards yielded high biases of approximately one standard deviation above the mean certified standard value (approximately 2%).

The Pb analysis exhibits a similar pattern to the low grade LGH standard. There is a weak high bias of approximately 1% and 2.4% of the standard samples have failed, which is an acceptable result.

Figure 13.3 Medium grade standard MGH results

Medium grade standard MGH by FA-GRAV for Ag

Medium grade standard MGH by ICP-OES for Pb

Standard NHBG01

846 high grade NHBG01 reference samples were submitted between December 2003 and April 2008, with accurate results (Figure 13.4). Pb and Cu analysis yields good results, with data points tightly constrained slightly above the mean certified standard value (Figure 13.4).

Figure 13.4 High grade standard NHBG01 results

High grade standard NHBG01 by FA-GRAV for Ag

High grade standard NHBG01 by ICP-OES for Pb

High grade standard NHBG01 by ICP-OES for Cu

13.2.2 Blank Samples

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. A blank sample is considered to have failed if the returned assay is greater than ten times the detection limit. Analysis of blank samples is useful for determining if cross-contamination of samples is occurring in the sample preparation or analysis process.

Aquiline submitted blank samples comprising barren basalt rock chips on a frequency of 1 in 37 samples. Blank sample results are good with a low number of failed samples (Table 13.2).

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Table 13.2 Blank sample results

Analytical method	Detection limit	Number of samples	Number of failed samples
Ag FA-GRAV	1 g/t	935	8
Pb ICP-OES	0.01%	2,111	3
Cu ICP-OES	0.001%	2,111	6

13.2.3 Duplicate drill core samples (field duplicates)

Field duplicate samples are duplicate samples that are taken at the primary sampling point. At the Navidad Project, where diamond drillhole core is sampled by taking half of the core extracted from the ground, a field duplicate is taken by submitting the remaining half of the core. Aquiline were selecting quarter core samples as field duplicates until mid 2007, when they began selecting half core samples. Field duplicates are submitted to measure the precision of the entire sampling, sample preparation, and analysis process. Field duplicates also provide a measure of the inherent variability of the mineralisation (the nugget effect).

2,186 duplicate sample results submitted since 2003 are available for analysis, for a submission frequency rate of 1 in 36 samples. 942 of the duplicate samples returned silver assays with values greater than the detection limit of the analytical instrument, for a submission frequency rate of 1 in 83 samples. Pan American should focus on field duplicate sampling in the mineralised zone, for a submission frequency of 1 in 20 samples.

A number of plots and graphs can be used to quantify precision and bias in the duplicate samples. These plots include:

Scatter plot: assesses the degree of scatter of the duplicate result plotted against the original (first) assay value, which allows for bias characterisation and regression calculations.

Precision plot: half of the absolute difference (HAD) of the sample pair values plotted against their average. The reference line indicates different levels of precision.

Relative difference plot: relative difference of the paired values divided by their average.

Ranked HARD plot: half absolute relative difference of samples plotted against their ranked value (samples are ordered from lowest to highest grade and ranked by percentile). For field duplicate samples in high nugget style deposits, the sample threshold is accepted to be 30% or below at the 90th percentile.

The results of the Navidad duplicate drill core samples show good precision and no evidence of sampling bias. Silver duplicate analyses tend to show some scatter, but are within acceptable tolerance limits. Precision plots yield good results at the field level, as an average of 80% of the data plot within 20% of their respective duplicate samples, while an average of 55% of the data plot within 10%. The results of the field duplicate samples are shown in Figure 13.5, Figure 13.6, and Figure 13.7.

Figure 13.5 Ag field duplicate samples analysed by FA-GRAV from 2003 until 2009

Normal scatter plot with threshold guidelines of 30%

Relative difference plot with threshold guidelines of 30%

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Precision plot

Ranked HARD plot

Figure 13.6 Pb field duplicate samples analysed by ICP-OES from 2003 until 2009

Normal scatter plot with threshold guidelines of 30%

Relative difference plot with threshold guidelines of 30%

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Precision plot

Ranked HARD plot

Figure 13.7 Cu field duplicate samples analysed by ICP-OES from 2003 until 2009

Normal scatter plot with threshold guidelines of 30%

Relative difference plot with threshold guidelines of 30%

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Precision plot

Ranked HARD plot

13.2.4 Independent statement of Navidad quality control samples

Snowden considers the results of the standard, blank, and field duplicate samples submitted for the Navidad Project to be of industry standard and do not indicate any significant source of bias, cross contamination, or inaccuracy.

14 Data verification

Information in this section has been sourced from Snowden (2009).

14.1 Field and laboratory quality control data reviews

In June 2003, Smee and Associates Consulting Ltd (Smee) were engaged to audit the laboratories of Alex Stewart in Mendoza and ALS Chemex laboratories of Coquimbo and Santiago, Chile, and to make recommendations as to the suitability of the methods used by these laboratories for the high grade samples expected to be submitted from the Navidad Project (Smee, 2003). The work involved a formal audit of the Alex Stewart laboratory, a visit to the ALS Chemex laboratory in Santiago, and a formal audit of the ALS Chemex laboratory at Coquimbo. Smee concluded that both laboratories were capable of meeting the required standards, but there would be some operational and turn around differences between the two options.

In April 2005, Smee conducted a review of the 2004 Navidad QAQC data and an audit of the procedures used at the Alex Stewart laboratory in Mendoza, Argentina (Smee, 2005a). No site visit was undertaken. Smee considered the laboratory facilities in Mendoza to comply with industry best practice methods for analysis, and that the QAQC Project data as at April 2005 was accurate, precise, free from contamination, and suitable for inclusion in Mineral Resource estimates. Smee recommended improvements in managing QAQC data; capturing and analysing the Alex Stewart internal QAQC data; initiating a plan of action for identifying QAQC failures and the corrective action required; improvements to diamond drill core cutting (orienting core and marking a cutting line); and taking half core samples for duplicates rather than quarter core samples.

In December 2005, Smee conducted a review of the 2004 and 2005 QC data and made recommendations as to the suitability of the analytical data to be included in resource estimations (Smee, 2005b). No site visit was undertaken. Smee considered the laboratory facilities in Mendoza were performing the analyses using industry accepted procedures and quality control protocols, and that the QAQC Project data as at December 2005 was accurate, precise, free from contamination, and suitable for use in resource estimations.

Smee recommended the purchase of a commercial software database to assist the capture of the analytical and quality control data.

In February 2008, Smee and Associates Consulting Ltd visited the Project and conducted a review of the Navidad QAQC data and procedures (Smee, 2008). Smee recommended improvements for the data compilation and in managing the QAQC data; to build a table of failures to document the course of action taken to correct or accept the failures; to document and describe the nature of the inserted blank and to determine the background values of the blank samples in order to establish a more precise warning limit. Smee calculated the sampling precision for some of the project deposits that showed that most areas have an overall sampling precision of nearly ±20%, which is expected for this style of mineralisation. Smee indicated that Calcite Hill mineralisation has a precision of ±30% which is considered to be high for this style of mineralisation and recommended investigating the source of this variation. It was recommended that the corresponding lithology symbol be attached to the duplicate samples to determine which lithology has the poorest precision. These recommendations have subsequently been implemented by Aquiline.

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14.2 Snowden independent site visits

Ms. De Mark conducted a site inspection of the Navidad Property from 10 September to 13 September 2007 and from 28 April to 30 April 2009. Ms. De Mark was involved in discussions with key Aquiline personnel (Table 14.1) and undertook the following activities:

— Reviewed geological plans and cross sections.

— Reviewed selected diamond drillhole logs and diamond drill core intersections.

— Reviewed diamond drill core logging, cutting, and sampling procedures.

— Selected mineralised intersections for independent analyses.

— Confirmed the coordinates of selected diamond drillhole collars by GPS.

— Inspected Aquiline's two operating diamond drilling rigs during the 2007 site visit. No diamond drill rigs were in operation at the time of Snowden's 2009 visit.

Table 14.1 Key Aquiline personnel involved in data verification discussions

Visit year	Name	Position
2007, 2009	John Chulick	Vice President of Exploration
2007, 2009	Sergio Kain	Senior Project Geologist
2007	Sophia Adamopoulos	Senior Project Geologist
2009	Dean Williams	Chief Geologist
2009	Damian Spring	Chief Mining Engineer

14.2.1 Independent review and sampling of mineralised intersections

Ms. De Mark examined mineralised intersections in 49 drillholes from the Barite Hill, Galena Hill, Connector Zone, Navidad Hill, Calcite Hill, Calcite NW, Loma de La Plata and Valle Esperanza deposits in 2007 and 2009 (Table 14.2). A number of the mineralised intersections selected by Snowden for review in 2009 were no longer available, as the drill core had been used for metallurgical testing. These missing intersections included drillholes NV08-658, NV07-618, NV08-681, NV08-732, NV08-765,

NV08-718, NV07-609, NV08-781, NV08-713, NV08-792, NV07-515, and NV07-543. No discrepancies were noted.

In 2007, Ms. De Mark confirmed the presence of diamond drill core for the Project, which is stored under cover at the Aquiline drill core storage facilities in Gastre. Further, she collected 30 quarter core duplicate samples from 25 drillholes (Table 14.3), and confirmed the presence of visible Ag mineralisation in drillhole NV07-442 (which returned assays of 22,818 g/t Ag from 223.55 m to 224.05 m downhole).

In 2007, the 30 independent quarter core samples were cut and sampled under Snowden supervision, and shipped to Vancouver, where the samples were submitted to Acme Laboratories of Vancouver, B.C. One sample of blank rock chips and two standard pulps were also submitted for analyses. Samples were crushed to 70% passing #10 mesh, split to 250 g, and pulverised to 95% passing #150 mesh. Au and Ag were analysed by fire assay on a 30 g sample. Base metal sulphides and precious metals were analysed by ICP-ES using hot Aqua Regia digestion of a 1 g sample.

The 31 independent samples selected by Snowden from 31 drillholes in April 2009 (Table 0.3) were cut and sampled under Snowden supervision, and shipped to Vancouver, where the samples were submitted to ALS Laboratories of North Vancouver, B.C. One sample of blank rock chips and four standard pulps were also submitted for analyses. Samples were crushed to 70% passing <2 mm mesh, pulverised to 85% passing <75 µm mesh, and split with a riffle splitter to obtain a 30 g charge. Ag was analysed by fire assay with gravimetric finish, and Pb was analysed using high grade four acid digestion and ICP-AES.

The purpose of independent sampling is to verify the presence of significantly mineralised intersections. Because of the limited number of samples, the size of the sample (quarter core), and slightly different sample preparation and analysis techniques used by the alternate laboratory, independent samples should not be considered as a QAQC sample. Snowden is of the opinion that the results of the independent samples selected in 2007 and 2009 are acceptable for duplicate samples of the style of mineralisation concerned.

Table 14.2 Snowden mineralised drill core intersection review

Review year	Hole number	Deposit	From	To
2007	NV06-309	Calcite NW	82.29	128.82
2007	NV06-355	Navidad Hill	33.4	59.78
2007	NV06-357	Navidad Hill	8.0	31.1
2007	NV06-358	Navidad Hill	0.0	19.05
2007	NV06-359	Navidad Hill	2.6	21.42
2007	NV06-367	Galena Hill	26.42	53.78
2007	NV06-369	Galena Hill	3.0	26.48
2007	NV06-370	Galena Hill	49.1	57.35
2007	NV06-374	Galena Hill	25.53	37.57
2007	NV06-378	Connector Zone	64.8	90.0
2007	NV06-381	Connector Zone	27.34	41.13
2007	NV06-386	Navidad Hill	36.7	64.45
2007	NV07-414	Calcite NW	20.1	39.1
2007	NV07-416	Calcite NW	39.8	54.1
2007	NV07-418	Calcite NW	56.0	64.4
2007	NV07-421	Calcite NW	25.14	50.14

2007	NV07-422	Calcite NW	24.56	54.7
2009	NV07-442	Barite Hill	216.14	240.75
2009	NV07-396	Barite Hill	90.2	120.2
2009	NV08-666	Galena Hill	119.09	157
2009	NV07-552	Galena Hill	3	26.48
2009	NV07-560	Connector Zone	15.33	47.75
2009	NV08-867	Connector Zone	193.8	235.36

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Review year	Hole number	Deposit	From	To
2009	NV08-726	Connector Zone	189.4	235.65
2009	NV07-615	Calcite Hill	39.06	52.14
2009	NV07-485	Calcite Hill	14.6	40.54
2009	NV07-617	Calcite Hill	6	36.5
2009	NV07-423	Calcite NW	35.17	68.5
2009	NV07-533	Calcite NW	28.78	45.44
2009	NV07-584	Calcite NW	0	22.7
2009	NV07-645	Calcite NW	46.43	76.48
2009	NV08-906	Loma de La Plata	299.78	340.82
2009	NV07-571	Loma de La Plata	151.56	201.88
2009	NV07-513	Loma de La Plata	24.67	56.87
2009	NV07-611	Loma de La Plata	207.58	231.84
2009	NV07-522	Loma de La Plata	51.3	75.29
2009	NV08-843	Loma de La Plata	217.66	266.16
2009	NV08-856	Loma de La Plata	87.46	111.6
2009	NV07-622	Loma de La Plata	261.1	274.18
2009	NV07-434	Loma de La Plata	0	18
2009	NV08-730	Valle Esperanza	170.59	206.19
2009	NV08-730	Valle Esperanza	249.57	271.63
2009	NV08-740	Valle Esperanza	239.25	256
2009	NV08-740	Valle Esperanza	391.63	416.42
2009	NV08-790	Valle Esperanza	49.97	66.5
2009	NV08-790	Valle Esperanza	77.85	92.12
2009	NV08-802	Valle Esperanza	128.1	161.52
2009	NV08-841	Valle Esperanza	268.12	282.36
2009	NV08-655	Valle Esperanza	180.2	202
2009	NV08-655	Valle Esperanza	220	230.2
2009	NV08-690	Valle Esperanza	179.98	212.6
2009	NV08-694	Valle Esperanza	198.36	237
2009	NV08-685	Valle Esperanza	218.8	232.65

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Table 14.3 Snowden independent samples

Review year	Deposit	Drillhole number	Original sample number	Snowden sample number	From	To	Original Ag g/t	Original Pb%	Snowden duplicate Ag g/t	Snowden duplicate Pb%
2007	Calcite NW	NV06-309	35026	18	85.5	88.5	403	0.21	390	0.19
2007	Navidad Hill	NV06-355	37702	23	50	51.5	442	0.27	163	0.51
2007	Navidad Hill	NV06-357	37799	29	22.15	23.17	392	0.13	140	0.18
2007	Navidad Hill	NV06-358	37839	27	4.8	5.4	240	0.28	175	0.39
2007	Navidad Hill	NV06-359	37879	26	4.6	6.04	239	0.11	196	0.1
2007	Navidad Hill	NV06-359	37885	24	10.25	11	1680	0.41	1176	0.52
2007	Galena Hill	NV06-367	38362	22	29.3	31.1	879	21.88	796	19.69
2007	Galena Hill	NV06-367	38363	25	31.1	32.2	503	18.65	492	19.38
2007	Galena Hill	NV06-369	38462	21	7.1	10.1	87	2.86	99	3.22
2007	Galena Hill	NV06-370	38583	30	55.85	55.6	2466	1.64	2125	2.02
2007	Galena Hill	NV06-374	38851	20	30.4	31.81	376	10.79	390	9.46
2007	Connector Zone	NV06-378	39098	16	83.1	85.8	289	0.06	581	0.09
2007	Connector Zone	NV06-381	39200	15	30.9	32.4	505	0.71	488	0.79
2007	Navidad Hill	NV06-386	39479	28	53.55	54.9	739	0.3	1073	0.33
2007	Calcite NW	NV07-414	41665	17	22.3	25.3	159	0.1	164	0.09
2007	Calcite NW	NV07-414	41671	14	34.3	36.2	159	0.11	148	0.15
2007	Calcite NW	NV07-416	41784	13	51.18	52	1074	3.41	464	3.95
2007	Calcite NW	NV07-418	41889	5	37	40	2227	4.18	129	0.07
2007	Calcite NW	NV07-421	42005	6	28	31	23	0.47	6	0.43
2007	Calcite NW	NV07-422	42047	12	46	47.55	390	0.19	372	0.24
2007	Calcite NW	NV07-425	42187	10	67	70	365	1.26	517	2.41
2007	Barite Hill	NV07-442	43442	19	222.19	222.58	7072	<0.01	1221	0.24

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Review year	Deposit	Drillhole number	Original sample number	Snowden sample number	From	To	Original Ag g/t	Original Pb%	Snowden duplicate Ag g/t	Snowden duplicate Pb%
2007	Barite Hill	NV07-442	43443	8	222.58	222.92	5469	0.01	1876	0.01
2007	Barite Hill	NV07-445	43780	7	198.15	199.6	1733	0.24	1197	0.12
2007	Barite Hill	NV07-463	45791	9	197.41	199	189	0.05	102	0.08
2007	Barite Hill	NV07-463	45793	11	199	200.49	111	0.04	110	0.02
2007	Barite Hill	NV07-467	46178	3	85	86.4	77	13.28	98	15.67
2007	Barite Hill	NV07-476	47116	4	19	22	99	3.01	151	4.37
2007	Calcite Hill	NV07-484	47656	1	36.6	39.05	304	0.07	288	0.07
2007	Calcite Hill	NV07-484	47658	2	40.3	42.6	815	0.17	518	0.16
2007	-	Standard	LGH-0324	31	-	-	111	6.73	73	2.32
2007	-	Blank	-	32	-	-	0	0	16	0.01
2007	-	Standard	MGH-0992	33	-	-	231	4.54	241	4.32
2009	Barite Hill	NV07-396	39986	93404	100.94	102.8	540	0.06	521	0.07
2009	Calcite NW	NV07-423	42089	93402	55	58	875	0.22	625	0.26
2009	Loma de La Plata	NV07-434	42689	93401	0	3	1628	0.005	3600	0.01
2009	Barite Hill	NV07-442	43444	93403	222.92	223.55	305	0.005	1575	0.00
2009	Calcite Hill	NV07-485	47682	93422	28.05	30.1	905	0.31	1200	0.32
2009	Loma de La Plata	NV07-513	49101	93396	49.5	51.8	1438	0.25	1495	0.30
2009	Loma de La Plata	NV07-522	49365	93397	70.41	71.27	6560	0.01	6030	0.02
2009	Calcite NW	NV07-533	55725	93425	33.73	34.55	2051	3.16	1360	2.57
2009	Galena Hill	NV07-552	56238	93415	19.7	22.7	106	2.03	103	1.89
2009	Connector Zone	NV07-560	56450	93420	22.13	23.5	564	1.33	433	1.10
2009	Loma de La Plata	NV07-571	50695	93395	159.45	162.45	1516	0.005	1390	0.01
2009	Calcite NW	NV07-584	57466	93426	6.76	7.6	123	1.59	102	1.76
2009	Calcite Hill	NV07-615	58649	93416	43.18	44.86	398	0.27	653	0.40

Review year	Deposit	Drillhole number	Original sample number	Snowden sample number	From	To	Original Ag g/t	Original Pb%	Snowden duplicate Ag g/t	Snowden duplicate Pb%
2009	Calcite Hill	NV07-617	58696	93424	25.5	27.8	636	0.07	381	0.08
2009	Loma de La Plata	NV07-622	52676	93400	264.52	266.29	4335	0.01	819	0.00
2009	Calcite NW	NV07-645	60123	93427	68.4	70.2	1036	0.23	1510	0.19
2009	Valle Esperanza	NV08-655	60759	93410	185	186	4487	0.05	3540	0.06
2009	Galena Hill	NV08-666	65176	93414	136	139	119	0.71	99	0.65
2009	Valle Esperanza	NV08-685	66502	93428	277.2	280.2	256	0.07	145	0.04
2009	Valle Esperanza	NV08-690	66947	93413	190.89	192.5	229	0.66	259	0.70
2009	Valle Esperanza	NV08-694	67218	93412	213	214	6017	0.34	6540	0.37
2009	Connector Zone	NV08-726	69251	93423	199	202	1206	0.005	866	0.01
2009	Valle Esperanza	NV08-730	69492	93405	205	208	4155	1.05	3090	0.91
2009	Valle Esperanza	NV08-740	69954	93406	244	245.67	207	0.14	164	0.09
2009	Valle Esperanza	NV08-790	81857	93407	62	64	120	0.07	125	0.07
2009	Valle Esperanza	NV08-802	82272	93408	147.65	148.62	4223	0.005	3740	0.01
2009	Valle Esperanza	NV08-841	83323	93409	272.39	274	219	2.59	193	2.68
2009	Loma de La Plata	NV08-843	73306	93398	228.3	230.3	7585	0.02	5060	0.02
2009	Loma de La Plata	NV08-856	73557	93399	97.2	98.7	8465	0.03	>10000	0.03
2009	Connector Zone	NV08-867	84241	93421	215.35	216.54	1247	0.17	1125	0.19
2009	Loma de La Plata	NV08-906	90594	93393	308.57	309.73	1618	0.005	2170	0.00
2009	-	Blank	-	93411	-	-	0	0	4	0.00
2009	-	Standard	L1	93418	-	-	655	0.31	623	0.31

2009	-	Standard	L2	93419	-	-	254	0.25	250	0.24
2009	-	Standard	L3	93394	-	-	91	0.09	95	0.09
2009	-	Standard	L3	93417	-	-	91	0.09	85	0.09

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14.2.2 Independent review of drillhole collar locations

Ms. De Mark visited 30 drillhole collars in 2007 and 2009, and measured the drillhole collar coordinates with a hand held GPS unit (Table 14.4). No discrepancies were noted in the coordinates beyond the accuracy of the hand held GPS.

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Table 14.4 Snowden verification of drill collar coordinates

Year	Drillhole number	Deposit	Snowden easting	Snowden northing	Snowden elevation	Aquiline easting	Aquiline northing	Aquiline elevation	Easting difference	Northing difference	Elevation difference
2007	NV07-403	Barite Hill	2516578	5302703	not taken	2516580	5302704	1124	2	1	
2007	NV07-461	Barite Hill	2516487	5302556	not taken	2516490	5302557	1124	3	1	
2007	NV06-284	Galena Hill	2515634	5303743	1163	2515637	5303742	1185	3	-1	22
2007	NV06-362	Navidad Hill	2514781	5304520	1209	2514783	5304516	1230	2	-4	21
2007	NV05-182	Calcite Hill	2513953	5304968	1218	2513952	5304968	1240	-1	0	22
2007	NV06-261	Calcite NW	2513549	5304867	1195	2513553	5304866	1221	4	-1	26
2007	NV07-559	Loma de La Plata	2511766	5303347	1255	2511767	5303344	1279	1	-3	24
2007	NV07-557	Loma de La Plata	2511678	5303352	1256	2511670	5303353	1284	-8	1	28
2007	NV07-522	Loma de La Plata	2511649	5303306	1264	2511649	5303304	1288	0	-2	24
2007	NV07-526	Loma de La Plata	2511600	5303307	1265	2511600	5303303	1290	0	-4	25
2009	NV08-906	Loma de La Plata	2512479	5303446	1216	2512481	5303449	1238.2	1.94	2.96	22.2
2009	NV08-769	Loma de La Plata	2511398	5302999	1336	2511398	5303000	1359.52	0.08	0.57	23.52
2009	NV08-761	Loma de La Plata	2511773	5303602	1241	2511774	5303601	1263.7	1.03	-1.48	22.7
2009	NV08-812	Loma de La	2511985	5303450	1234	2511984	5303451	1257	-0.69	0.57	23

		Plata									
2009	NV08-886	Loma de La Plata	2512230	5303497	1237	2512233	5303499	1260.88	2.5	2.18	23.88
2009	NV08-868	Loma de La Plata	2512154	5303147	1247	2512155	5303149	1268.44	1.31	1.86	21.44
2009	NV07-490	Bajo de Plomo	2512157	5302342	1271	2512156	5302344	1290.17	-1.18	1.95	19.17
2009	NV07-647	Filo de Plomo	2512612	5301980	1281	2512613	5301982	1301.79	1.33	2.16	20.79
2009	NV07-642	Calcite NW	2513949	5305156	1194	2513951	5305156	1211.89	1.64	-0.46	17.89
2009	NV07-641	Calcite NW	2513828	5305136	1192	2513831	5305142	1210.52	2.56	6.44	18.52
2009	NV08-914	Calcite NW	2513440	5304766	1201	2513442	5304770	1220.53	1.84	4.33	19.53
2009	NV08-717	Calcite NW	2515200	5304118	1134	2515203	5304122	1151.28	2.59	3.57	17.28

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Year	Drillhole number	Deposit	Snowden easting	Snowden northing	Snowden elevation	Aquiline easting	Aquiline northing	Aquiline elevation	Easting difference	Northing difference	Elevation difference
2009	NV08-653	Valle Esperanza	2515157	5303338	1121	2515156	5303338	1140.04	-1.36	0.07	19.04
2009	NV08-847	Valle Esperanza	2515163	5303346	1120	2515163	5303348	1139.97	0.21	2.1	19.97
2009	NV08-763	Valle Esperanza	2514984	5303144	1125	2514986	5303147	1144.45	1.74	3.24	19.45
2009	NV08-736	Valle Esperanza	2515003	5303081	1122	2515002	5303082	1145.77	-0.54	1.26	23.77
2009	NV06-300	Valle Esperanza	2515178	5303087	1122	2515178	5303087	1140.94	-0.43	-0.06	18.94
2009	NV04-025	Valle Esperanza	2515365	5302999	1119	2515366	5302999	1140.05	1.4	0.08	21.05
2009	NV04-077	Valle Esperanza	2514691	5303436	1133	2514689	5303435	1151.16	-1.92	-1.3	18.16
2009	NV08-690	Valle Esperanza	2514813	5303362	1127	2514817	5303361	1148.23	3.84	-0.99	21.23

14.2.3 Independent review of original assay certificates

In 2007 and 2009, Snowden obtained original assay certificates for comparison against the database. Original assay certificates were emailed directly to Snowden from the Alex Stewart Mendoza laboratory. Snowden reviewed 89 certificates for 8,427 assays, and noted no discrepancies. A list of the work order numbers, date received at the laboratory, and the sample numbers is shown in Table 14.5.

Table 14.5 Snowden review of original assay certificates

Review year	Work order	Certificate date	Sample numbers from	Sample numbers to
2007	M060593	22/05/2006	34937	35023
2007	M060603	23/05/2006	35024	35117
2007	M060855	16/07/2006	37667	37758
2007	M060859	18/07/2006	37759	37868
2007	M060874	21/07/2006	37869	37962
2007	M061581	4/12/2006	38331	38440
2007	M061592	16/12/2006	38441	38536
2007	M061593	7/12/2006	38537	38638
2007	M061610	11/12/2006	38759	38882
2007	M061631	11/12/2006	38985	39100
2007	M061643	12/12/2006	39101	39222
2007	M061695	18/12/2006	39436	39555
2007	M070089	22/01/2007	40299	40385
2007	M070281	15/02/2007	41625	41716
2007	M070290	16/02/2007	41717	41814
2007	M070297	19/02/2007	41815	41904
2007	M070327	22/02/2007	41995	42085
2007	M070360	27/02/2007	42171	42253
2007	M070459	12/03/2007	42576	42651
2007	M070727	10/04/2007	43416	43508
2007	M070746	16/04/2007	43707	43792
2007	M070926	7/05/2007	44714	44799

2007	M071070	31/05/2007	45730	45821
2007	M071110	6/05/2007	46153	46244
2007	M071226	25/06/2007	47110	47194
2007	M071256	29/06/2007	47284	47367
2007	M071305	10/07/2007	47633	47738
2009	M070290	16/02/2007	41717	41814
2009	M070297	19/02/2007	41815	41904

Review year	Work order	Certificate date	Sample numbers from	Sample numbers to
2009	M070298	29/02/2007	41905	41994
2009	M070671	9/4/2007	43328	43415
2009	M070727	10/4/2007	43416	43508
2009	M070956	15/05/2007	44964	45049
2009	M070976	17/05/2007	45050	45138
2009	M070990	21/05/2007	45139	45264
2009	M071305	10/7/2007	47633	47738
2009	M071513	21/08/2007	49308	49404
2009	M071515	21/08/2007	49405	49490
2009	M071561	27/08/2007	55643	55711
2009	M071562	27/08/2007	55712	55810
2009	M071622	9/3/2007	56170	56250
2009	M071635	9/5/2007	56251	56335
2009	M071640	9/5/2007	50152	50245
2009	M071646	9/7/2007	56424	56514
2009	M071647	9/10/2007	50246	50326
2009	M071980	22/10/2007	52165	52239
2009	M072018	29/10/2007	58657	58757
2009	M072019	29/10/2007	52240	52336
2009	M072042	30/10/2007	58758	58794
2009	M072089	5/11/2007	52531	52608
2009	M072090	11/5/2007	52609	52680
2009	M072106	5/11/2007	52681	52763
2009	M072231	16/11/2007	58858	58949
2009	M072244	20/11/2007	58950	59021
2009	M072334	26/11/2007	59022	59105
2009	M080049	14/01/2008	60351	60421
2009	M080060	16/01/2008	60422	60521
2009	M080065	21/01/2008	60598	60697
2009	M080072	23/01/2008	60698	60785
2009	M080137	28/01/2008	60786	60890

2009	M080160	29/01/2008	60977	61102
2009	M080183	2/4/2008	65102	65188
2009	M080270	7/2/2008	65189	65324
2009	M080487	22/02/2008	66385	66460
2009	M080530	28/02/2008	66461	66556

Review year	Work order	Certificate date	Sample numbers from	Sample numbers to
2009	M080706	11/3/2008	67015	67157
2009	M080734	17/03/2008	67158	67255
2009	M080753	17/03/2008	67256	67344
2009	M080755	11/3/2008	66937	67014
2009	M081415	10/5/2008	69162	69380
2009	M081417	11/5/2008	69381	69541
2009	M081465	15/05/2008	69542	69643
2009	M081997	7/7/2008	81005	81101
2009	M082019	31/07/2008	69162	69380
2009	M082020	4/7/2008	69381	69541
2009	M082026	7/10/2008	81102	81192
2009	M082077	16/07/2008	81193	81326
2009	M082282	14/08/2008	82212	82305
2009	M082295	15/08/2008	82306	82401
2009	M082415	1/9/2008	87728	87818
2009	M082503	070/09/2008	87819	87901
2009	M082580	16/09/2008	73178	73227
2009	M082611	19/09/2008	73228	73318
2009	M082667	24/09/08	73319	73373
2009	M082751	3/10/2008	73507	73577
2009	M082752	3/10/2008	73578	73647
2009	M082840	8/10/2008	84137	84225
2009	M082844	9/10/2008	84226	84276
2009	M082845	9/10/2008	84277	84326

15 Adjacent properties

Information in this section has been sourced from Snowden (2009), which excerpted from Chulick, (2007).

Third parties control mineral tenements to the west, north, and east of the Navidad claim block. No public information is available for the properties to the north and east and little work is believed to have been conducted on them.

15.1 Patagonia Gold

The mineral tenements to the west of Navidad tenements are held by Patagonia Gold Plc. Information concerning these properties is made public on their website at http://www.patagoniagold.com. Information used in this technical report is derived from this source.

Snowden cannot independently verify any of the information provided by Patagonia Gold on their website. Additionally, whatever information Patagonia Gold provides is not necessarily indicative of the mineralisation located on the Navidad Properties

The mineralisation described by Patagonia Gold in their 2003 Annual Report is distinct from that found at Navidad. The mineralisation described is consistent with the low sulphidation style of epithermal type systems with stated evidence of silica sinters and fissure veins, large zones of argillic alteration and elevated geochemical values in gold, silver, copper, mercury, arsenic, and antimony. This style of mineralisation is distinct from the style of mineralisation observed at Navidad.

Patagonia Gold has stated that they have drilled 14 reverse circulation (RC) drill holes for a total of 1,430 m. They do not provide locations for this drilling. In their 2006 report, Patagonia Gold reported assay results of 1.66 g/t Au over 1 m in drillhole GAS-10 and 3.9 g/t Ag over 1 m in drillhole GAS-05. No Mineral Resources or Mineral Reserves are mentioned on the website.

15.2 Mina Angela

A group of exploited and abandoned base metal veins referred to as Mina Angela is located some 46 km to the north-northwest of the centre of Galena Hill. This occurrence of northeast trending veins dips vertically to 80º towards the northwest. Mineralisation was first discovered in the 1930s and later exploited in the mid-1970s by Cerro Castillo S.A. who operated a 120 t per day plant, later expanded to 400 t per day, until the close of operations in 1993.

Historical Mineral Reserve figures made available by Cerro Castillo in 1986 are shown as 593,760 t in the Proven category with grades of 3 g/t Au, 55 g/t Ag, 5.04% Zn, 1.98% Pb, and 0.049% Cu. These figures are reported here for historical purposes only; the reader should make no comparison of the estimates with current Mineral Resource reporting standards. The remaining Mineral Resources at the time of shut-down are not known.

The vein mineralisation, which is primarily quartz with base metal sulphides, occurs as individual bodies localised along fault planes up to 500 m in length and 2.5 m in width over a total strike length of 1.6 km. Host rocks are andesite breccias and flows believed to be Jurassic in age and assigned to the Lonco Trapial Formation.

15.3 Flamingo Prospect

The Flamingo Prospect is a 7 km by 5 km prospect located approximately 30 km southwest from the Navidad Project and held in the name of Minera Aquiline Argentina S.A. To date exploration work has consisted of preliminary geological mapping plus the collection of 299 rock chip and 120 BLEG samples in this area of presumed Jurassic age volcanic rocks which are tentatively assigned to the Lonco Trapial Formation. Five vein structures with epithermal to mesothermal characteristics have been identified with strike lengths up to 4 km. In April 2005 Aquiline published a news release which highlighted the results of 21 rock chip samples:

— Au values ranging from 0.03 g/t Au to 9.70 g/t Au, with nine samples greater than 1.0 g/t Au.

— Ag values ranging from 0 g/t Ag to 1,530 g/t Ag, with six samples greater than 50 g/t Ag.

— Cu values ranging from 0.01% Cu to 14.15% Cu, with 11 samples greater than 1.0% Cu.

— Zn values ranging from 0.00% Zn to 1.45% Zn, with two samples greater than 0.5% Zn.

— Pb values ranging from 0.00% Pb to 9.20% Pb, with five samples greater than 0.5% Pb.

The Flamingo area, which lies along the Río Chubut northwest structural trend and parallel to the Gastre structural corridor, was excluded from Aquiline’s aeromagnetic and radiometric survey of 2008 due to operational reasons.

16 Mineral processing and metallurgical testing

Information in this section has been sourced from Snowden (2009).

16.1 Mineral processing and metallurgical testing by IMA from 2005 to 2006

The following sections regarding mineral processing and metallurgical testing in 2005 and 2006 by IMA have been excerpted from Snowden (2006a) and Snowden (2007).

Between October 2004 and October 2005, G&T Metallurgical Services Ltd (G&T) of Kamloops, British Columbia performed differential flotation test work and mineralogical analyses on samples of mineralisation taken by IMA from the Galena Hill, Navidad Hill and Calcite Hill deposits (G&T 2005a; G&T 2005b; G&T 2005c; G&T 2005d). In addition, two brief mineralogical studies were performed in November 2005 (G&T 2005e; G&T 2005f) to examine the forms and distributions of pyrite within selected composite samples.

All sample preparation, flotation test work, and assaying was performed at the G&T facilities in Kamloops, which have ISO 9001:2000 accreditation. All of the test work was performed under the direct supervision of Mr Tom Shouldice, P. Eng. Mr. Peter Taggart, P. Eng., provided overall programme direction and acted as the Owner's Representative.

Individual samples of split drill core were shipped from the Navidad Project site to the G&T facilities in Kamloops, British Columbia, Canada. Each individual drill core sample was identified and weighed upon receipt. This data, together with notes indicating the condition of the drill core samples as received was recorded.

To prepare each composite, the drill core samples were crushed using a primary jaw crusher followed by a secondary cone crusher. The crushed drill core samples were blended and the entire composite was staged screened and cone crushed until the particle size was 98% passing 2 mm.

After preparation, each composite was thoroughly homogenised, applying the "cone and quarter" method, and subdivided into metallurgical test charges using a rotary splitter. All test charges were purged with nitrogen, sealed in plastic bags and stored in a freezer at –10°C to minimise the risk of oxidation. During the homogenising stage, representative duplicate sub samples were removed and pulverised in preparation for chemical analysis. These head samples were analysed for copper, lead, zinc, iron, sulphur and silver contents using standard analytical techniques.

16.1.1 Flotation test work

G&T conducted flotation test work on 14 samples comprising intervals of quartered core that were crushed and homogenised at the G&T facilities. Nine of the composites were from Galena Hill, three from Navidad Hill, and two from the Calcite Hill deposit. The drillholes used to produce the samples, and the corresponding metal contents, are shown in Table 16.1.

Table 16.1 Head grades of composite drillhole samples used for metallurgical test work

Deposit	Sample	Drillhole number	Ag (g/t)	Pb (%)	Cu (%)	Zn (%)
Galena Hill	NVGH-5b/6b	NV04-56,57	76	3.1	0.02	0.40
	NVGH-6a	NV04-57	143	4.86	0.01	0.40
	NVGH-6b	NV04-57	107	3.60	0.00	0.43
	NVGH-7a	NV04-42	466	3.90	0.04	0.30
	NVGH-7b	NV05-42	297	3.70	0.07	0.20
	NVGH-12	NV05-175	264	8.0	0.02	0.50
	NVGH-13	NV05-197	300	4.90	0.03	0.20
	NVGH-14	NV05-197	82	1.30	0.03	0.10
	NVGH-15	NV05-197	340	0.40	0.14	0.20
Navidad Hill	NVNH-8a	NV04-116	435	3.50	0.40	0.10
	NVNH-8b	NV04-116	389	3.20	0.30	0.10
	NVNH-9a	NV04-54,109	265	0.30	0.50	0.10
Calcite Hill	NVCH-10a	NV04-88	72	8.50	0.00	0.10
	NVCH-11a	NV04-88	320	0.3	0.10	0.10

Two basic flow sheets were used to examine the flotation response of the composite samples.

— When the lead sulphide content of the sample warranted, separate lead and silver concentrates were produced. The latter would include principally pyrite, other sulphide minerals and silver minerals. This strategy is applicable to all composites representing the Galena Hill mineralisation.

— When the lead sulphide content was deemed too low, a single, silver-rich bulk sulphide concentrate was produced. This flow sheet is applicable to all the Navidad Hill composites, and to Calcite Hill composite 11a. Calcite Hill composite 10a mineralisation is relatively rich in galena, but low in other sulphides. Accordingly, for this sample the single concentrate produced is, by default, a high grade lead product.

G&T performed one or more rougher/scavenger kinetic tests on each composite sample. These test data were used to assess relative rates of flotation, and basic flotation conditions required in the rougher/scavenger stage under a variety of flotation conditions. In some instances modal analyses were performed to determine the degree to which rougher concentrates should be reground.

Upon completion of the rougher scavenger tests, open circuit cleaner tests were performed to examine various cleaner flotation conditions. Finally, a limited number of locked cycle tests were performed on many samples to examine the most promising test conditions in a continuous mode. It is noted that, while the locked cycle tests provide the best source of data on which to base metallurgical projections, the work performed at this stage on these deposits was at the scoping, or exploratory level.

While considerable progress was achieved, much work remained to optimise flotation conditions for these deposits. Table 0.2 provides a summary of all flotation tests performed to date by G&T.

Table 16.2 Summary of flotation tests

Deposit	Composite	Number of Tests and Descriptions		
		Roughers	Cleaners	Locked Cycle
Galena Hill	NVGH-5b/6b	2	11	1
	NVGH-6a		3	
	NVGH-6b		3	
	NVGH-7a	1	3	
	NVGH-7b	1	5	1
	NVGH-12	2	6	1
	NVGH-13	6	2	
	NVGH-14	1	2	
	NVGH-15	1	2	
Navidad Hill	NVNH-8a	8	2	
	NVNH-8b	2	2	1
	NVNH-9a	7	4	1
Calcite Hill	NVCH-10a	6	3	1
	NVCH-11a	7	3	1
	Total	43	51	7

Flotation test results

The G&T reports referenced contain detailed descriptions of the sample origins, test procedures and results produced in each of the four programs. Variability in results for any particular composite sample generally reflects the variety of flotation conditions that were routinely addressed in work of this nature. Once standard conditions were established, open circuit cleaner and locked cycle flotation tests were performed to confirm the most probable metallurgical performance, based on the scoping work conducted to date.

The locked cycle test procedures provide for the re-circulation of test products and, therefore, best represent the conditions that would exist in an operating plant. All locked cycle tests conducted by G&T achieved stability.

The Galena Hill and Navidad Hill composite samples were typically ground to a nominal sizing of 80% passing 74 µm to 80 µm, prior to flotation. The superior fragmentation characteristics afforded by the Calcite Hill mineralisation allowed flotation feed grind sizing with the range 80% passing 150 µm to 180 µm to be adopted.

Galena Hill

The lead contents of all Galena Hill samples justified the sequential production of selective lead and pyrite concentrates. It is evident from the flow sheets that some differences in metallurgical response exist between composite samples. The reasons for these differences have yet to be clearly determined, but could include differences in composite sample grades, mineralogical composition and fragmentation characteristics. Differences in results produced from tests performed on the same composite sample generally reflect differences in flotation test conditions. Silver recoveries to the pyrite concentrate were highly variable, depending to a large extent on the amount of silver recovered to the lead concentrate and to the lead cleaner tailings streams. The columnar chart indicates that the total recovery of silver in the two final concentrates varies generally within the range of 50% to 70%.

The adopted flow sheet and the results generated by the three locked cycle tests performed on Galena Hill composite samples confirmed the cleaner test results, and reveal the variability in metallurgical response between composite samples. Further, in all cases, the pyrite rougher tail comprises the most significant source of silver loss incurred during processing. The subsequent investigation of pyrite deportment, by species, in the various test products is discussed in Section 16.1.3.

Samples of concentrates were analysed for minor elements. No deleterious elements were observed in quantities that would seriously constrain product marketability or attract significant penalties in these particular samples.

Differential flotation was effectively applied to produce selective lead and silver-rich pyrite concentrates from composite samples of this mineralisation although significant work is needed to increase the silver recovery overall and produce a concentrate that can be sold or re-processed for silver recovery.

Navidad Hill

A single bulk concentrate was produced when testing each of the three composites of the Navidad Hill mineralisation.

In general, the open circuit cleaner test flow sheet and the results achieved when testing composites 8A, 8B, and 9A show a similar pattern, with a 15,000 g/t Ag concentrate grade achieved at a nominal 60% silver recovery. Variability in test data is again largely attributed to differences in test conditions.

A single locked cycle test was performed on composites 8b and 9a of the Navidad Hill mineralisation. The lead metallurgical performance was adversely affected by relatively high non-sulphide lead components (anglesite and cerussite) of the samples. Almost all the lead contained in the concentrate produced from composite 8b was present as the non-sulphide minerals cerussite and anglesite. It is possible that further test work, based on commercially-proven sulphidisation procedures, might enhance the lead grades and recovery. The concentrate produced from composite 8b contained 972 g/t As, 1,494 g/t Mn and 42 g/t Hg, all of which could attract modest smelter penalties.

The low lead content of the feed was detrimental to lead performance in composite 9a. Composite 9a yielded better silver and copper results than corresponding values achieved from composite 8b. X-Ray Diffraction (XRD) analysis of the composite 9a concentrate indicated that most of the copper was present as malachite. The reasons for differences in silver metallurgy generated by the two tests are not fully understood at this stage. The 9a concentrate contained 1,826 g/t As and 1,539 g/t Mn, both of which could result in some minor smelter penalty.

The differential flotation was effectively applied to produce selective lead and silver-rich pyrite concentrates from composite samples of this mineralisation although significant work is needed to increase the silver recovery overall and produce a concentrate that can be sold or re-processed for silver recovery.

Calcite Hill

Two composite samples of Calcite Hill mineralisation were examined, designated 10a and 11a. The superior fragmentation characteristics of these samples permitted the primary grind to be adjusted from the normal 75 µm to grinds within the range of 80% passing 150 µm to 180 µm. A single concentrate was produced in each case. Composite 10a was rich in galena and produced excellent lead metallurgical results.

Lead concentrate grades approximating 80% Pb at lead recoveries of 90% were achieved. Notwithstanding the relatively low silver content of the 10a composite (72 g/t Ag), the silver minerals were amenable to selective flotation, with silver recoveries exceeding 80% at 500 g/t Ag concentrate grades. Composite 11a, though of low sulphide content, produced a high silver recovery with a 10,500 g/t Ag concentrate grade.

The lead metallurgy produced in the locked cycle test on the two Calcite Hill composite samples matched that achieved in the open circuit tests. However, the locked cycle silver metallurgy indicated an improvement, when compared to the open circuit results grade of the lead concentrate.

The concentrates produced from the locked cycle tests were devoid of deleterious elements in amounts that would attract smelter penalties.

Mr. Chlumsky concluded that a single high grade lead concentrate, containing high silver values, was successfully produced from Calcite Hill composite 10a. From Calcite Hill composite 11a a single bulk concentrate containing high silver values was successfully produced. Mr. Chlumsky also concluded that this type of mineralisation should be further pursued for first development of the Project cash-flow.

16.1.2 Mineralogy overview

The minerals of economic interest are those containing lead and silver. The principal sulphide minerals include galena (PbS), pyrite (FeS_2), chalcopyrite ($CuFeS_2$) and sphalerite (ZnS). Lead sulphosalts, lead carbonate and other sparsely distributed copper minerals were also present in some samples. The variable mineralogical compositions of the deposits are evidenced in the mineral deportments within the individual composites, as shown in Table 16.3.

Table 16.3 Mineral composition of composite samples

Deposit	Sample	CS	Ga	Sp	Py	Gn
Galena Hill	NVGH-5b/6b	0.1	3.2	0.6	5.8	90.3
	NVGH-7a	0.1	4.2	0.4	213.3	82.0
	NVGH-7b	0.2	3.7	0.3	7.0	88.8
	NVGH-12	<0.1	8.1	0.7	12.0	79.1
	NVGH-13	<>1	4.8	0.3	6.4	88.4
	NVGH-14	<.1	1.0	0.2	3.3	95.5
	NVGH-15	<.1	0.3	0.3	3.3	96.1

Deposit	Sample	CS	Ga	Sp	Py	Gn
Navidad Hill	NV04-116	0.2	0.3	0.2	0.3	99.1
	NV04-116	0.2	0.3	0.1	<0.1	99.4
	NV04-54,109	0.1	0.1	0.2	0.6	99.0
Calcite Hill	NV04-88	-.05	8.4	0.09	0.6	90.9
	NV04-88	0.16	0.3	0.04	0.5	99.0

Cs-copper sulphides, Ga-galena, Sp-sphalerite, Py-pyrite, Gn-non-sulphide gangue

Galena Hill mineralogy

Fine-grained galena and pyrite were the dominant sulphide minerals in the Galena Hill composites. An array of copper sulphides, copper bearing sulphosalts and sphalerite were also detected in trace amounts. The sulphide minerals, which comprised 10% to 20% by weight of the composite samples, were contained in a carbonate rich volcanic host.

Electron microprobe studies have shown silver to be contained interstitially within the pyrite lattice and to a much lesser extent in the galena lattice. Mineralogical studies at G&T (G&T 2005e and G&T 2005f) have determined that pyrite is present in at least two forms. The dominant form is anhedral pyrite, which includes spongiform pyrite. Subhedral pyrite is present to a lesser extent. Optical microscopy studies were undertaken to assess the influence which differences in pyrite speciation may impart to silver concentrate grades and recoveries in the flotation process.

Navidad Hill mineralogy

Sulphide minerals comprised less than 1% of each of the three Navidad Hill composite samples. The sulphides observed included copper sulphides, galena, sphalerite and pyrite, all contained within calcite and quartz hosts. The non-sulphide host rock contained significant amounts of montmorillonite and kaolinite. Microscopic examination of flotation concentrate samples, produced in rougher tests on composites 8A and 9A, revealed the presence of silver-bearing freibergite ((Cu,Fe)12Sb4S13)) and proustite / pyrargyrite (3Ag2S.As2S3 / 3Ag2S.Sb2S3) minerals.

The presence of non-sulphide minerals, such as anglesite (PbSO4), cerussite (PbCO3) and malachite (CuCO3.Cu(OH)2) was also reported. These minerals, in conjunction with the low sulphide mineral content ores, would adversely affect flotation performance.

Calcite Hill mineralogy

The two Calcite Hill composites, 10a and 11a, differed considerably in their mineralogical compositions. Composite 10a contained almost 10% by weight sulphides, most of which were present as galena. In both composites, approximately half the copper was present as chalcopyrite, one third as covellite (CuS), and the remainder as chalcocite (Cu2S). The mineralisation is coarser than that examined in all other composite samples. Composite 11a contained only 1% by weight sulphide minerals. Silver was present as native silver, as argentite-acanthite (Ag2S), and as stromeyerite (AgCuS).

In both samples, freibergite accounted for approximately 60% of the silver, while minor amounts of proustite-pyrargyrite were reported. Metallic silver was observed in small amounts.

16.1.3 Modal analyses

Modal analyses were conducted on most of the composite samples to assess the fragmentation characteristics of the mineralisation. The values shown in Table 16.4 indicate the percentage of each mineral, or mineral suite, which is liberated at the nominal sizing shown.

Flotation feed grinds within the range of 80% passing 70 µm to 80 µm are commonly applied prior to the differential flotation of polymetallic ores.

In general, the liberations of most sulphide minerals were quite variable, and commonly less than 50%. However, it is evident that, at the sizings shown, the non-sulphide gangue was well liberated. These conditions are conducive to the physical separation of the gangue from the sulphides in the rougher flotation stage. The data also suggest, however, that regrinding of some rougher/scavenger concentrate may be required to achieve acceptable cleaner circuit grade/recovery performance. The galena in Calcite Hill composite 10a exhibits favourable fragmentation characteristics, being liberated to the extent that a coarser flotation feed grind could be applied.

Table 16.4 Summary of fragmentation characteristics

Deposit	Composite	Size	Mineral liberation in two dimensions-%				
		K80µm	Cs	Ga	Sp	Py	Gn
Galena Hill	NVGH-5b/6b	80	58	52	27	39	89
	NVGH-7a	86	26	44	29	55	90
	NVGH-7b	80	33	38	21	26	83
	NVGH-12	74	19	47	18	36	81
	NVGH-13	74	38	39	24	21	86
	NVGH-14	71	53	29	9	21	85
	NVGH-15	76	38	28	12	23	88
Navidad Hill	NV04-116	66	38	20	45	68	95
	NV04-116	65	50	8	48	43	98
	NV04-54,109	70	10	19	18	62	98
Calcite Hill	NV04-88	63	31	79	15	65	98
	NV04-88	74	21	30	<1	40	99

Cs-copper sulphides, Ga-galena, Sp-sphalerite, Py-pyrite, Gn-non-sulphide gangue

16.1.4 Sample grindability

G&T conducted standard Bond Ball Mill Work Index tests on some samples to determine the hardness of the mineral composites (Table 16.5).

Table 16.5 Bond ball mill work indices values

Deposit	Composite	Bond ball mill indices (kWhr/tonne)
Galena Hill	NVGH-12	12.5
	NVGH-13	13.5
	NVGH-14	11.5
	NVGH-15	12.8
Navidad Hill	NV04-116	10.7
	NV04-116	Na
	NV04-54,109	11.9
Calcite Hill	NV04-88	13.7*
	NV04-88	18.9*

*These are comparative values based on results from sample 8a, to which a standard Bond test was applied to assess grindability.

With the exception of composite NVCH-11a, the samples are considered to be of average to moderate grindability. The values observed for Bond Mill Work Index are typical of those recorded for ores from many polymetallic massive sulphide deposits.

16.2 Mineral processing and metallurgical test work by Aquiline in 2007

The following section regarding mineral processing and metallurgical test work by Aquiline in 2007 has been excerpted from Snowden (2007), with the exception of Sections 16.2.5 and Section 16.2.6 which were issued to Aquiline since the Snowden (2007) Technical Report.

Additional work commenced at G&T Metallurgical Services composites from the Navidad Hill and Calcite Hill deposits in 2007.

This test work was been undertaken on the Navidad Hill and Calcite Hill portions of the Navidad Hill Project because of the excellent results obtained during the past test work as reported previously in the Navidad Hill and Calcite Hill Test Work sections. These results indicate that a high grade silver concentrate may be made from each of these separate mineralised areas. The test work followed the same initial framework as the tests reported previously and was expanded to test the variations in lithology and mineralogy of these areas and to confirm that good recoveries and silver grades could be obtained from the material.

16.2.1 Navidad Hill

Four metallurgical samples for Navidad Hill were selected to reflect the spatial variability in grade and metal ratios observed in the mineralisation. A plan of sample locations is shown in

Figure 16.1. Two samples (NV01 and NV02) are from the top portion of the hill. Sample NV01 represents higher silver and copper values than does the NV02 sample. Sample NV03 is drawn from holes on the southern flank of the hill where both the silver and copper values are relatively modest. The last sample, NV04 is from the western portion of the deposit and consists of intercepts with both high grade silver and copper values.

Figure 16.1 Location plan of Navidad Hill and Connector Zone drill collars of samples selected for metallurgical studies

The samples can be characterised as:

— NV01: Top of Navidad, Ag with high Cu

— NV02: Top of Navidad, Ag with low Cu

— NV03: South Navidad, lower Ag and low Cu

— NV04: East Navidad, high Ag and high Cu

Samples NV01 and NV02 are hosted completely within the latites as no sediments overlay the upper portion of the hill. Due to the relatively small amount of mineralisation in this sector of the deposit both sediment and volcanic hosted intervals were combined to achieve the target sample size. The majority of the mineralisation in the area from which the NV04 sample was taken is hosted in breccias located beneath sediments and over the volcanic rocks, although a few of the samples were hosted within the volcanic rocks.

16.2.2 Barite Hill

Mineralisation in this zone is hosted in undifferentiated sediments consisting of intercalated mudstones to sandy conglomerates and volcaniclastic derived from the felsic volcanic rocks. The mineralisation consists of black sulphides and locally as native silver. The native silver although locally spectacular (i.e., drillhole NV07-442) is believed to represent only a minor component of total mineralisation. Because the coarse native silver does not represent a significantly large fraction of the total mineralisation in the zone, it was purposely avoided in the selection of samples. The majority of the mineralisation occurs as black silver sulphides. These minerals occur as disseminations within the host rocks and as the matrix of crackle breccias. The tenor of the silver mineralisation ranges from low to high grade. In addition to silver, the zone contains only trace amounts of lead and zinc and locally minor mounts of copper. Because of the physical similarities between the two host lithological units, the criteria for sample selection focused upon separating medium to lower grade and higher grade mineralisation. The two samples selected for test work are:

— Sample BH01 - Barite Hill medium grade Ag with low Pb, Zn, and Cu. This sample has an estimated weight of 55.6 kg with a calculated silver grade of 271 g/t Ag. Lead and zinc values are low and copper is calculated at 0.22%.

— Sample BH02 - Barite Hill high grade Ag with low Pb, Zn, and Cu. This sample has an estimated weight of 57.9 kg with a calculated silver grade of 897 g/t Ag. Once again, the Zn and Pb values are low with a calculated copper grade of 0.36%.

16.2.3 Loma de La Plata

Mineralisation is hosted by brecciated latite lavas, which are exposed at surface on the top of the ridge, but are covered by sediments both down dip and down slope to the east. Sample selection attempted to separate the more oxidised mineralisation that is exposed at surface from less oxidised mineralisation encountered at depth. The two samples selected for test work were:

— Sample LP01- Loma de La Plata shallow samples high silver with low Cu, Pb, and Zn. This sample has an estimated weight of 56.2 kg and a silver grade of 920 g/t Ag. The Pb, Zn, and As values are low with a weighted average copper grade of 0.13%. The sample consists of near surface mineralisation with an average depth of only 10.1 m. All samples are from less than 21 m depth. The core is logged as oxide rich and some high grade samples close to surface may reflect supergene enrichment.

— Sample LP02 - Loma de La Plata deeper samples high silver with low Cu, Pb, and Zn. This sample has an estimated weight of 57.7 kg and a silver grade of 661.8 g/t Ag. The average depth of the samples in this composite is 54.3 m and all samples are from below 45 m depth. This sample is believed to represent less oxidised mineralisation.

16.2.4 Galena Hill

Three samples of pyrite concentrates from the original G&T Metallurgical Services test programme were submitted for additional mineralogical evaluations to Xstrata Process Support (XPS) in Sudbury, Ontario. The investigation was to determine if additional beneficiation can take place with this concentrate and increase the overall value of the product.

16.2.5 Discussion of G&T results

Results in this section from the flotation test work are excerpted from the G&T report (2008).

A total of twelve composite samples representing six zones within the Navidad Project were tested in this programme. Ore hardness and mineralogical tests were carried out on a suite of eight samples from the Calcite Hill and Navidad Hill zones. The additional four samples from the Calcite NW, Connector Zone, Barite Hill and Loma de La Plata deposits were subjected to flotation testing. Figure 0.2 shows the location of samples taken from Calcite Hill and Calcite NW.

Figure 16.2 Location plan of Calcite Hill and Calcite NW drill collars of samples selected for metallurgical studies

The average Bond ball mill work index for seven samples from Calcite Hill and Navidad Hill was 14.5 kWh/tonne (test results were unstable for three of the eight samples submitted for Bond Wi testing. One sample could not be tested because the feed was too fine). This level of hardness indicates that the sample suite tested is of medium hardness. The Bond ball mill work indices ranged between about 13 kWh/tonne and 16 kWh/tonne across both the Calcite Hill and Navidad Hill samples.

Modal analyses were carried out on nine samples from Calcite Hill, Navidad Hill and Loma de La Plata. The modal results revealed that the sulphide content ranged from about 0.4% to 22% in these samples. Composite CH-03 contained 20% galena and, as a result, this sample had much higher sulphide content compared to the other samples. Pyrite content ranged from 0.1% to 2.6% and is the dominant sulphide in only the NV-02 composite.

In general, the copper sulphide minerals are poorly liberated at the target primary grind sizing of about 70µm K80. The majority of the non-liberated copper sulphides are in binary form with non-sulphide gangue. There are also significant quantities of copper sulphide minerals in the multiphase particles.

By contrast, the galena is relatively well liberated in the Calcite Hill and Navidad Hill samples. With the exception of the NV-02 composite, liberation levels for galena ranged from 52% to 68%. The majority of the non-liberated galena occurs in binary form with non-sulphide gangue.

SEM-EDX (scanning electron microscope energy-dispersive X-ray spectroscopy) analysis was carried out on final concentrate from test 90, on the Loma de La Plata composite. Silver bearing minerals present included native silver, argentite, polybasite and iron bearing pearcite. A number of the silver bearing minerals are also arsenic and antimony carriers.

The twelve composites tested had a highly variable metal content for copper, lead and silver in the feed. This variation in feed metal content impacts significantly on the metallurgical performance.

Concentrates produced from these composites ranged widely in concentrations of silver, lead and copper. The concentrates can be characterised as copper, lead, bulk copper-lead or silver concentrates. Silver recovery into the final concentrates ranged between 35% and 96%, with an average silver recovery to final concentrate of about 72%. The average silver grade in the final concentrate was about 32,000 g/t. The silver grade in the concentrate tended to increase with increasing silver grade in the feed.

The Loma de La Plata composite contained low levels of copper and lead in the feed. The silver content in the single composite tested was about 710 g/t, considerably higher than the average resource grade for this zone. Production of a low mass-high grade silver concentrate was readily achievable with this sample. The best test results indicate about 74% of the silver was recovered into a cleaner concentrate containing about 168 kg/t silver.

Consideration should be given to conducting a metallurgical programme on representative samples from the Loma de La Plata deposit. The copper and lead levels are reported to be uniformly low for this zone. The near absence of copper and lead may facilitate production of a high grade silver concentrate at acceptable silver recovery levels. The Loma de La Plata deposit appears to represent the best target for further metallurgical testing based on the results of this test programme.

16.2.6 Discussion of XPS results

Results from the mineralogical test work are excerpted from the XPS report (2007).

Three Galena Hill pyrite concentrates with different size distributions were submitted for mineralogical evaluation. The main objective of the study was to assess upgrading potential of these concentrates. Modal mineralogy, sulphide and gangue liberation, mineral compositions, and Ag and Pb deportment are quantified.

Results indicate that these concentrates are low grade and contain considerable amounts of liberated non-sulphide gangue, dominated by orthoclase, quartz, kaolinite and barite. Although present in all size fractions, the gangue component is largest in the fine size fractions. These fine particles may have been recovered through entrainment. There is a very good opportunity to upgrade these concentrates by inserting cleaning and entrainment controls into the circuit such as froth washing and column flotation as proposed in the XPS Virtual Flowsheet concept presented in previous reports. In order to simulate cleaning potential of these concentrates, a digital upgrading exercise was performed where all liberated (>90%) non-sulphide gangue was removed from the samples. In such a scenario, pyrite grades would increase from 17.9% to 46.4%. Lead, silver and zinc grades would each increase by a factor of 2.5.

A deportment analysis of the three concentrates indicates that on average 83% of total Ag is contained within pyrite. Trace amounts of acanthite (Ag2S) were identified and account for 9% to 16% of all Ag in the samples. Where identified, these grains are generally very small and occur locked within quartz. Low levels of Ag are also found in solid solution within sphalerite and account for 2% to 3% of total Ag in the concentrates. Solid solution Ag was not identified in galena. XRD results indicate there are trace amounts of marcasite in the samples but the majority of the Fe sulphide is pyrite.

Pyrite grains contain variable levels of Pb, Ag, and As in solid solution within the crystal structure. Pb grades in pyrite average 2.75%, whilst Ag grades in pyrite average 0.17%. A small proportion of the pyrite grains contain very high levels of Pb (>8%). High Pb-bearing pyrites (likely marcasite), have a corresponding high level of Ag. In addition to containing 83% of the total Ag in the concentrates, pyrite also contains 17% of the Pb.

Galena grains are moderately liberated. Fine textures with quartz and pyrite prevent perfect liberation even at a P80 of 16µm. At the same time, there is evidence that soft galena grains have been overground, and as a result have not been recovered in the lead circuit. A total of 25% to 35% of galena is ultra-fine and liberated in all three samples.

16.3 Mineral processing and metallurgical test work by Aquiline in 2008

Samples for metallurgical test work on the Loma de La Plata deposit were selected during a site visit by XPS personnel in January 2008. The location plan of Loma de La Plata samples are shown in

Figure 16.3. These samples were sent to both XPS in Sudbury Canada and to G&T Metallurgical Laboratory in Kamloops, Canada. Subsequent variability metallurgical testing was performed on composites of samples from the same drillhole, which marks a departure from previous test work, where composites comprised samples from a number of drillholes. This test work was carried out during 2008, under the general direction of John Wells, an independent Consulting Metallurgist, working on behalf of Aquiline. The XPS test work was carried out in two phases, and was completed in February 2009, with the Phase 1 report issued in August 2008 (XPS, 2008) and the Phase 2 report issued in March 2009 (XPS, 2009). The Loma de La Plata test work at G&T was completed in May 2008 and their report issued in June 2008 (G&T, 2008).

The number of samples taken from Loma de La Plata, and the details of the test work carried out by both G&T and XPS are, in the view of Mr. Wells, sufficient to support a Feasibility Study on this deposit. The reports, containing all of the test work results are all issued, and will be summarised in this technical report.

Figure 16.3 Location plan of Loma de La Plata drill collars of samples selected for metallurgical studies

Following completion of the Loma de La Plata work, a limited number of samples were provided to G&T from the Barite Hill and the Valle Esperanza deposits. The location of the Barite Hill samples is shown in Figure 16.4 and the location of the Valle Esperanza samples is shown in Figure 16.5. This test work was carried out in the first quarter of 2009, and a report issued in April 2009 (G&T, 2009). This work will also be summarised in this technical report. The work on these two deposits was more limited then the Loma de La Plata work, and based upon fewer samples. However, Wells regards the work as sufficient to support conceptual studies, and is probably suitable for Prefeasibility Studies.

Figure 16.4 Location plan of Barite Hill drill collars of samples selected for metallurgical studies

F i g u r e 16.5 Location plan of Valle Esperanza drill collars of samples selected for metallurgical studies

General conclusions and recommendations are provided. In general the results can be considered as very encouraging, with high silver recoveries and concentrate grades generally achieved. The flotation concentrates contain some copper and lead, suggesting that the concentrates will find a ready market, probably to copper smelters. The base metals will be minor contributors to the overall revenue, where by far the largest contribution will be from the silver content.

Some of the Barite Hill and Valle Esperanza concentrates do contain levels of minor metals, such as arsenic and antimony, which exceed commonly accepted smelter penalty limits. However, as the tonnage of the high grade silver concentrate is small (relative to, for example, the output from a copper concentrator) the actual quantity of such minor metals will be small, and unlikely, in Mr. Wells' view, to become a commercial issue. However, this will require review during the Prefeasibility Study, with at least some preliminary discussions with potential smelters.

The test work strongly suggests that the mineral processing of Loma de La Plata, Barite Hill, and Valle Esperanza can be carried out in a single, simple, mineral processing facility (crushing, grinding and a single stage of flotation to produce a high grade silver, low copper plus lead, flotation concentrate). All of this technology is simple and well proven. The only area identified by the test work as of concern, was the poor liquid/solids separation of the residues from Barite Hill and Valle Esperanza. Further investigation of this will be necessary. The samples were typically soft to medium hardness, which will reduce the size and power of the comminution (crushing and grinding) circuit.

The various test programs at XPS and G&T are summarised in the following sections of this technical report.

16.3.1 XPS Phase 1 test work on Loma de La Plata samples

This test work is described in full in XPS (2008) and is summarised in this section.

XPS carried out metallurgical test work using drill core samples collected on site in January 2008. The study included mineralogical and metallurgical test work on two geo-metallurgical units, defined as the oxide zone and the sulphide zone. It is important to note that in both zones, the mineralogy of the silver, copper and lead are all sulphide, the term "oxide" is only a visual definition based on the general appearance of the core. Both zones responded well to standard flotation mineral processing techniques. The geo-metallurgical units are described in Table 16.6.

Table 16.6 Loma de La Plata geo-metallurgical units

Geo-metallurgical Unit	Domain	Characteristics
Unit 1	"Sulphide" – high grade	High Ag sulphides, high Pb, low Cu
Unit 2	"Sulphide" – low grade	Low Ag sulphides, low Pb, high Cu
Unit 3	"Oxide" – high grade	High Ag sulphides, high Pb, low Cu
Unit 4	"Oxide" – low grade	Low Ag sulphides, low Pb, high Cu

The six holes chosen for the variability composites and the assay grades are shown in Table 16.7.

Table 16.7 Grades of sample composites used for variability testing

Hole number	Ag grade (g/t)

		Cu grade (%)	Pb grade (%)	Zn grade (%)
NV07-497 (oxide)	726	0.11	0.17	0.01
NV07-501 (oxide)	422	0.06	0.16	0.01
NV07-543 (oxide)	209	0.03	0.11	0.02
NV07-540 (sulphide)	90	0.03	0.12	0.03
NV07-526 (sulphide)	341	0.06	0.01	0.01
NV07-566 (sulphide)	209	0.10	0.08	0.03

The test work included quantitative evaluation of materials by scanning electron microscopy (QEMSCAN) and electron probe micro analyser (EPMA) mineralogical work, together with open circuit rougher flotation test work on all six composites, reagent exploration, bond work index determinations, and preliminary cleaner flotation on two of the composites. Some cyanidation test work was carried out, as a possible alternative process to flotation.

The following main observations and conclusions were noted from this Phase 1 work. Mineralogical evaluations identified silver sulphides as the main source of silver, predominantly acanthite and stromeyerite. Both disseminated and coarse grained silver minerals exist. Average silver mineral grain sizes are in the range of 11 µm to 20 µm, but some acanthite and stromeyerite grains exceeding 300 µm were observed. Relatively low levels of arsenic and antimony occur, generally associated with silver bearing tetrahedrite and tennantite. The core samples tested indicated that arsenic and antimony will generally be below smelter penalty limits, but that some ore grade control may be required from time to time.

Exploratory cleaning tests produce high silver concentrate grades ranging between 43 kg and 50 kg of silver per tonne of concentrate. As no locked cycle tests were carried out in this phase, it was not possible for XPS to make any firm prediction of recovery. However, the silver recoveries to the rougher concentrates were generally above 85%, and this indicates to Mr. Wells that potential overall silver recoveries would be in excess of 80%. This prediction has been supported by XPS Phase 2 test work and the G&T test work.

Some cyanide leach test work was carried out as a possible alternative to flotation. The perceived advantage to a cyanide route would be the production of a final doré product in Argentina. Recoveries from the cyanide tests were generally comparable to rougher floatation (between 80% and 90%). However this work was not continued into Phase 2 due to the long leach time required (48h) which represents high cost, as well as the high consumption of cyanide.

The cleaner concentrate grades are summarised in Table 16.8.

Table 16.8 Cleaner concentrate grades

Composite	Ag grade (kg/t)	Cu grade (%)	Pb grade (%)	Zn grade (%)
Oxide	50.8	3.1	14.5	0.2
Sulphide	43.1	13.1	1.1	1.2

16.3.2 XPS Phase 2 test work on Loma de La Plata samples

The test work is described in full in XPS (2009), and is summarised in this section.

XPS performed an optimisation test work module on samples of the Loma de La Plata deposit. This work covered oxide and sulphide ore types, each at high and low grades. Drill core was used as the sample material. This phase of work was based on recommendations obtained from the first phase of test work that Aquiline developed at XPS.

Physical composite samples were prepared using External Reference Distributions. This XPS proprietary method allowed a quality check to be performed. The grades of the sample composites are shown in Table 16.9.

Reagent optimisation was performed in flotation tests arranged in a factorial structure, or design of experiments (DOE). These tests were performed in open cycle and locked cycle format. In a similar manner, the flotation feed grind size and slurry percent solids were optimised. A preliminary examination of type of pH modifier was also made. Rougher concentrate regrinding was also tested to assess its potential influence on concentrate grade and recovery. Finally, variability analysis was performed on a range of ore samples to determine whether a relationship could be established between silver head grade and recovery.

Table 16.9 Grades of sample composites used for optimisation test work

Composite description	Ag ppm	Pb%	Cu%	S%	Fe%	Zn%	Au ppm	As%	Sb%
Sulphide low grade	92.6	0.025	0.037	0.230	2.75	0.028	-	0.001	-
Sulphide high grade	348.6	0.068	0.065	0.288	2.95	0.031	-	0.004	0.004
Sulphide composite	159.5	0.034	0.047	0.290	2.70	0.028	-	0.002	-
Oxide low grade	83.8	0.019	0.038	0.290	2.77	0.027	-	0.004	-
Oxide high grade	386.2	0.065	0.067	0.352	2.87	0.030	-	0.004	-
Oxide composite	207.8	0.043	0.040	0.229	2.94	0.018	-	0.003	-

Grinding Variability

Variability testing on the sulphide ores, performed at a target grind size P80 of 105 µm, showed that the batch grinding times required to attain this target varied from 6 minutes to 38 minutes. At the same P80, the oxide samples showed less variability with a range of batch grinding times of 18 minutes to 36 minutes. It is a recommendation that Pan American consider the potential influence of this observation in their design of the grinding circuit. A study simulating the grinding circuit responses to this variance is proposed.

Reagents

A reagent suite using 42.5 g/t of Aerophone 3418A and 33.8 g/t of Potassium Amyl Xanthate (PAX) is recommended. These collectors were stage added during the flotation protocol and manage to produce significant silver and copper recovery gains by improving silver kinetics. Metallurgical selectivity was maintained in the same silver grade recovery curve.

Interpretation of this result into a plant operating strategy is recommended. To fulfil further engineering stage requirements, it is a recommendation that reagents distribution be assessed via pilot plant campaigns as a prerequisite to plant design.

Flotation Feed Grind Size and Percent Solids

Grind size and slurry percent solids in flotation feed proved to be key parameters in subsequent flotation performance. It is recommended that the percent solids be kept in the range of 26% to 33% when performing rougher flotation of sulphide and oxide ores. The sulphide ore is much more sensitive than the oxide ore to an increase in the slurry percent solids, which causes a significant decrease in silver concentrate grade.

The particle size should be kept at a P80 of about 105 µm and 150 µm for the oxide ore and at about 60 µm for the sulphide ore. This will produce silver recoveries ranging from 78% to 80% for oxide ore and silver recoveries ranging from 79% to 89% for sulphide ore, if the slurry percent solids are maintained at indicated values above.

Flotation Feed Retention Time

An additional eight minutes of flotation time produced a silver recovery increment of 2.5% when analysing the oxide ore behaviour. It is recommended that retention time in the flotation circuit be studied as a trade-off in the plant design, i.e. the cost of capital to deliver this extra retention time versus the recovery gain.

pH Modifiers

Neither soda ash nor lime had a positive impact on metallurgical performance when compared to tests at natural pH. Silver recoveries decreased between 1% and 13% with no clear gains in silver concentrate grade.

Due to tight economical conditions, it was not possible to assess the metallurgical performance that the different geo-metallurgical units defined in Phase 1 of this test work would have when exposed to the newly defined metallurgical conditions. XPS recommend that this assessment is performed at a later stage of the Project.

Difference between oxide and sulphide ores

Significant differences between the oxide and sulphide ores were observed. The sulphide ore produces higher recoveries but lower concentrate grades than the oxide ore. A further module of work testing blends that correspond to the mining plans is recommended.

The locked cycle tests performed using sulphide ore produced an average final silver recovery of 83.8%, ranging from 81.7% to 88.7%. The silver concentrate grade averaged 44.4 kg/t Ag and ranged from 41.8 kg/t Ag to 46.0 kg/t Ag.

The locked cycle tests performed using oxide ore produced an average final silver recovery of 72.6%, ranging from 70.2% to 73.7%. The silver concentrate grade averaged 88.9 kg/t Ag and ranged from 87.9 kg/t Ag to 89.3 kg/t Ag. These values exceeded expectations of 50.0 kg/t. The oxide ore silver recovery can be further increased by increasing retention time in the rougher circuit, which would cause the silver concentrate grade to decrease.

For both ores it was found that recycling the cleaner scavenger tailings to the rougher flotation stage #2 improves concentrate quality while maintaining silver recovery. Under these circumstances, silver recoveries comparable to the open circuit data, together with saleable concentrate at grades at or in excess of 50.0 kg/t Ag, whilst maintaining or improving silver recovery, were achieved.

Further work can include:

— Including one extra stage of cleaning.

— Mixing the sulphide ore with the oxide ore.

— Regrinding the sulphide ore at a P80 smaller than 20 µm.

— Increasing residence time in rougher flotation to increase silver recovery.

XPS has developed a good understanding of Loma de La Plata ore metallurgical performance and believes that further gains can be achieved if the recommendations indicated in this report are implemented.

16.3.3 G&T test work on Loma de La Plata samples

The test work is described in full in G&T (2008). G&T had previously carried out work on other samples from Navidad (Snowden, 2007). The 2008 test work on Loma de La Plata used samples from the same January 2008 sample selection programme as were used by XPS.

The samples received by G&T (166 individual samples, 432 kg total) are listed in detail in G&T (2008). The samples were used to construct nine variability composites and one master composite. The master composite was constructed proportionately to the weights of the nine variability composites.

The grades of the variability samples and the master composite are shown in Table 16.10.

Table 16.10 Grades and specific gravity of the sample composites used for variability testing

Sample number	Cu grade (%)	Pb grade (%)	Ag grade (g/t)	S grade (%)	Sb grade (g/t)	As grade (%)	Specific gravity
502	0.05	0.1	415	0.19	104	0.008	2.60
504	0.03	0.04	219	0.15	90	0.005	2.59
508	0.05	0.01	143	0.14	108	0.003	2.53
515	0.05	0.03	250	0.64	125	0.003	2.53
555	0.09	0.03	253	0.51	116	0.005	2.51
564	0.03	0.04	153	0.21	148	0.002	2.54
575	0.08	0.04	243	0.24	158	0.003	2.49
602	0.18	0.14	287	0.62	235	0.015	2.42
611	0.06	0.37	289	0.40	156	0.002	2.51
Master composite	0.07	0.08	259	0.33	146	0.002	2.61

The bond mill work index of the master composite was 16.2 kWh/t. Work indices of the nine variability composites ranged from 12.3 kWh/t to 23.1 kWh/t.

The nine variability samples and the master composite were subject to open circuit and locked cycle testing. The master composite was used to carry out preliminary flow sheet development work using rougher and open circuit cleaner tests. This was followed by two locked cycle tests (test 23 and 26) on the master composite, the results of which are provided in Table

16.11 and Table 16.12.

Table 16.11 Locked cycle test conditions

Stream	Grind P80 (µm)	3418A Reagent Addition g/t	PAX Reagent Addition g/t	pH
Rougher	108-148	80	80	8.5
Regrind	16-22	-	-	8.5
Cleaner	-	50	40-50	8.5

Stream	Grind P80 (µm)	3418A Reagent Addition g/t	PAX Reagent Addition g/t	pH

Note: No Regrind was applied in Test 23. The unground rougher concentrate P80 was 16 µm. The rougher concentrate produced in Test 26 was ground for 2 minutes to a P80 of 22 µm.

Table 16.12 Summary of locked cycle test results

Test number	Product	Wt%	Ag grade (g/t)	Cu grade (%)	Pb grade (%)	S grade (%)	Ag recovery (%)	Cu recovery (%)	Pb recovery (%)	S recovery (%)
Test 23, P80 108 µm	Flotation Feed	100.0	285	0.07	0.09	0.3	100	100	100	100
	Bulk Concentrate	0.5	49888	7.2	11.9	9.6	83	52	62	16
	Bulk 1st Cleaner Tail	3.0	290	0.05	0.17	0.5	3	2	6	5
	Bulk Rougher Tail	96.5	40	0.03	0.03	0.2	14	45	32	79
Test 26, P80 148 µm	Flotation feed	100.0	264	0.07	0.09	0.3	100	100	100	100
	Bulk Concentrate	0.4	51071	8.1	12.8	10.5	77	48	59	16
	Bulk 1st Cleaner Tail	9.6	3.5	0.10	0.14	0.4	11	15	15	15
	Bulk Rougher Tail	90.0	33	0.03	0.03	0.2	11	37	26	69
	Flotation feed	100.0	264	0.07	0.09	0.3	100	100	100	100
	Bulk Concentrate	0.4	51071	8.1	12.8	10.5	77	48	59	16

The nine variability composites were subject to batch open circuit cleaner tests. With the exception of sample 508, silver recoveries ranged from 78% to 90%, with approximately 50 kg/t Ag in the final cleaner concentrates. Sample 508 yielded a recovery of 58% which may reflect it being the lowest feed grade (143g/t Ag and 0.14% S).

A silver association model was developed to demonstrate the relationship between silver content, and the copper and lead content in the concentrates. This model showed an excellent linear correlation between silver, lead and copper in the concentrates, indicating that the silver co-floats with the copper and lead minerals.

G&T carried out Automated Digital Imaging Scans (ADIS) of the final concentrates and rougher tailings. The silver minerals identified by G&T in the concentrates were principally native silver, proustite, acanthite and polybasite.

A sample of the final concentrate from Test 23 was sent for grade analysis by ICP at ALS Chemex Lab in Vancouver. The assays of the most important revenue and penalty elements are shown in Table 16.13.

Table 16.13 Assay grades of Test 23 locked cycle concentrate

Element	Grade
Ag (g/t)	> 1,000

Element	Grade
As (g/t)	1,620
Cd (g/t)	130
Cu (%)	6.6
Pb (%)	>10.0
S (%)	9.0
Sb (g/t)	1,935
Zn (%)	0.4

An initial opinion is that this concentrate would be shipped to an offshore copper smelter. The main component of the revenue (over 95%) would be the silver, with a minor credit for the copper. Minor penalties for lead, arsenic and antimony might be incurred. The average arsenic and antimony analyses of the variability composites were 2,232 g/t Sb and 1,680 g/t As. Only one sample was above this (sample 602) indicating some potential attention to ore blending in the mining operation.

A settling test on the tailings from Test 23 showed a thickener area of about 0.06 m²/t/day would be required, with a flocculant addition of 5 g/t, resulting in a thickened slurry of 48% solids by weight.

A limited number of tests were carried out to recover silver using gravity and cyanidation techniques (48 hours leach). The results are summarised in Table 16.14.

Table 16.14 Gravity and cyanidation test data results

Test number	Type	Pan concentrate silver extraction (%)	CN silver extraction (%)	Overall extraction (%)	CN kg/t	Lime kg/t
27	Whole ore CN	-	75	75	1.0	0.7
25	Gravity	18	-	-	-	-
28	Gravity Tail CN	-	69	-	1.3	1.1
25 + 28	Gravity + CN	18	57	75	-	-

Both the whole ore and gravity plus cyanidation flow sheets produced silver recoveries of about 75%. Inclusion of a gravity step did not increase overall silver recovery (based upon this single test). It would therefore appear that about 75% of the silver contained in the master composite can be recovered using cyanidation techniques or gravity plus cyanidation. This compares to 80% to 85% silver recovery to a flotation concentrate. The cyanide consumption in these tests is significantly lower than the XPS test. This would require confirmation if this line of test work is pursued in future.

16.3.4 G&T test work on Barite Hill samples

The test work is described in detail in G&T (2009). In a similar method as developed for the Loma samples, nine variability samples and a master composite were prepared from the core samples. A detailed sample inventory is provided in G&T (2009). However, the amount of work conducted on Barite Hill was more limited than the Loma de La Plata programme.

The grades of the Barite Hill sample composites are shown in Table 16.15.

Table 16.15 Grades of Barite Hill sample composites

Sample number	Cu grade (%)	Pb grade (%)	Zn grade (%)	Fe grade (%)	Ag grade (g/t)	S grade (%)	Sb grade (g/t)	As grade (%)
1	0.03	0.28	0.054	2.4	64	0.61	19	99
2	0.03	0.08	0.061	2.3	50	0.87	11	97
3	0.25	0.03	0.029	2.3	169	0.62	11	412
4	0.07	0.34	0.057	2.7	254	0.25	5	252
5	0.14	0.70	0.084	1.9	548	1.12	27	519
6	0.31	0.03	0.033	2.4	691	0.72	18	826
7	0.01	0.04	0.012	3.1	71	0.17	2	43
8	0.13	0.02	0.018	3.1	162	1.56	6	110
9	0.14	0.20	0.016	2.2	306	0.79	4	172
Master	0.17	0.20	0.050	2.6	190	0.75	14	257

The samples received at G&T were in the form of sample assay coarse rejects, and therefore too fine sized to carry out standard Bond ball mill work index tests. However it was possible to calculate a comparative work index using grind calibration data and the Bond Wi data from Loma de La Plata. Based on this, the Barite Hill material is classified as soft, with an average work index of 8.1 Kwh/t.

Rougher flotation test recoveries of about 90%, at a mass recovery of 6% to 8% were achieved. The recovery appeared to be relatively insensitive to primary grind P80s between 85 µm and 140 µm.

Batch open circuit cleaner tests were carried out on the master composite. Silver recoveries and grades of about 80% and 20 kg/t Ag respectively were achieved.

The results of two locked cycle tests on the master composite are summarised in Table 16.16 and Table 16.17.

Table 16.16 Locked cycle test conditions

Stream	Grind P80 (μm)	3418A Reagent Addition g/t	PE26 Reagent Addition g/t	pH
Rougher	84-140	30	50	8.2
Regrind	12-20	-	-	8.0

Stream	Grind P80 (µm)	3418A Reagent Addition g/t	PE26 Reagent Addition g/t	pH
Cleaner	-	30-50	200	8.2

Table 16.17 Summary of locked cycle test results

Test number	Product	Wt%	Ag grade (g/t)	Cu grade (%)	Pb grade (%)	S grade (%)	Ag recovery (%)	Cu recovery (%)	Pb recovery (%)	S recovery (%)
Test 10, P 80 140 µm	Flotation feed	100.0	194	0.11	0.17	0.5	100	100	100	100
	Bulk concentrate	0.6	24,401	11.8	22.7	13.6	81	71	84	19
	Bulk 1st cleaner tail	4.0	344	0.27	0.52	1.2	7	10	12	10
	Bulk rougher tail	95.4	25	0.02	0.01	0.4	12	19	4	72
Test 11 P80 84 µm	Flotation feed	100.0	222	0.12	0.17	0.6	100	100	100	100
	Bulk concentrate	0.7	24,343	11.5	18.3	13.3	76	65	73	17
	Bulk 1st cleaner tail	5.2	580	0.37	0.63	1.3	13	16	19	12
	Bulk rougher tail	94.1	24	0.02	0.02	0.4	10	19	8	71

Nine variability samples from Barite Hill were tested, with feed grades varying widely from 60 g/t Ag to 700 g/t Ag, at a P80 grind of about 100 µm. The flotation results varied from 65% to 85% Ag recovery, for silver concentrate grades of 25 kg/t Ag. There is a close correlation between the silver grade and the combined lead and copper grade in the concentrate. For 25 kg/t Ag concentrates, the combined lead plus copper grade is 30% to 35%. Acanthite/argentite are the dominant silver minerals in the concentrate. Thus in general, Barite Hill gave flotation results similar to Loma de La Plata, but with lower silver concentrate grades. This concentrate should be of interest to copper smelters.

The settling test on tailings from the locked cycle tests indicate Barite Hill does not settle well with low projected thicker underflow density and high calculated areas. Further more detailed work is required to investigate this.

Final bulk concentrates samples were analysed using Standard Assay Protocol, the key revenue and potential penalty elements are shown in Table 0.18, which provides comparative data for Barite Hill, Valle Esperanza, and Loma de La Plata. Preliminary discussions indicate that these concentrates would be best sold to copper smelters. More detailed discussions should be held during the Feasibility Study. Attention is drawn to the higher arsenic content of Barite Hill and the higher arsenic and antimony levels in Valle Esperanza. Due to the small volume (tonnage) of the concentrates and high value, they would be shipped from site in sealed containers minimising in-transit loses and any environmental concerns. The actual mass of antimony and arsenic is small, and should not present a significant problem to smelters. However some penalties will be incurred and this issue requires further evaluation.

Table 16.18 Barite Hill, Valle Esperanza, and Loma de La Plata concentrate grades

Element	Valle Esperanza grades	Barite Hill grades	Loma de La Plata grades
Sb g/t	14,090	986	1,935
As g/t	14,400	22,130	1,620
Cd g/t	380	1,250	130
Cu%	14.8	11.9	6.6
F g/t	118	257	n.a.
Fe%	8.2	3.7	8.3
Pb%	23.2	22.7	10.0 +
Hg g/t	262	38	n.a.
Ag g/t	63,584	24,421	50,000 +
S%	18.1	13.6	9.0
Zn%	21.8	19.5	4.5

16.3.5 G&T test work on Valle Esperanza samples

This test work is described in detail in G&T (2009). A similar programme was followed as for Barite Hill, with nine variability samples and a composite, as shown in Table 16.19.

Table 16.19 Grades of Valle Esperanza sample composites

Sample number	Cu grade (%)	Pb grade (%)	Zn grade (%)	Fe grade (%)	Ag grade (g/t)	S grade (%)	Sb grade (g/t)	As grade (%)
1	0.01	0.14	0.028	3.4	39	0.058	15	18
2	0.03	0.13	0.023	3.6	52	0.08	27	26
3	0.11	0.01	0.031	2.5	71	0.503	98	133
4	0.06	0.35	0.018	3.5	243	0.54	33	37
5	0.07	0.13	0.020	3.5	217	0.78	47	60
6	0.09	0.55	0.210	2.7	318	1.14	21	16
7	0.10	0.15	0.049	3.1	486	0.64	82	85

8	0.08	0.03	0.040	2.2	419	1.06	26	108
9	0.14	0.30	0.060	2.0	827	0.61	75	46
Master	0.08	0.12	0.047	3.0	268	0.50	62	70

As with Barite Hill, the samples received were sample assay coarse rejects, which therefore precluded standard Bond mill tests. Comparative work index data shows the samples to be of medium hardness with an average of 14.6 kWh/t. Rougher flotation test silver recoveries were over 90% at primary grind P80's between 90 µm and 165 µm. Batch open circuit cleaner test yielded what can be viewed as excellent silver recoveries (over 90%) and final bulk concentrates assaying between 60 kg Ag and 65 kg of silver per tonne.

Three locked cycle tests were carried out on the Valle Esperanza master composite and the results are summarised in Table 16.20 and Table 16.21.

Table 16.20 Locked cycle test conditions

Stream	Grind P80 (µm)	3418A Reagent Addition g/t	MIBC Reagent Addition g/t	pH
Rougher	89-166	30	60	8.5
Regrind	19-23	-	-	8.5
Cleaner	-	20	60	8.5

Table 16.21 Summary of locked cycle test results

Test number	Product	Wt%	Ag grade (g/t)	Cu grade (%)	Pb grade (%)	S grade (%)	Ag recovery (%)	Cu recovery (%)	Pb recovery (%)	S recovery (%)
Test 10, P 80 166 µm	Flotation feed	100.0	276	0.08	0.12	0.3	100	100	100	100
	Bulk concentrate	0.4	65,461	14.5	23.1	17.9	92	71	74	20
	Bulk 1st cleaner tail	1.7	598	0.37	0.59	0.9	4	8	8	5
	Bulk rougher tail	97.9	12	0.02	0.02	0.3	4	21	17	75
Test 11 P80 89 µm	Flotation feed	100.0	320	0.08	0.19	0.4	100	100	100	100
	Bulk concentrate	0.5	60,324	11.7	29.1	17.2	92	73	75	20
	Bulk 1st cleaner tail	1.5	954	0.46	1.19	1.4	4	9	9	5
	Bulk rougher tail	98.0	12	0.01	0.03	0.3	4	18	15	75
Test 21 P80 89 µm	Flotation feed	100.0	272	0.07	0.18	0.4	100	100	100	100
	Bulk concentrate	0.5	52,555	12.0	28.6	10.0	91	76	73	13
	Bulk 1st cleaner tail	1.1	1118	0.41	1.02	1.2	5	6	6	4

Bulk rougher tail	98.4	12	0.01	0.04	0.3	4	18	20	83

The silver recoveries and concentrate grades achieved in the locked cycle test were better than either Loma de La Plata or Barite Hill and can be considered very satisfactory.

Nine variability samples from Valle Esperanza were tested, with feed grades varying from 50 g/t Ag to 800 g/t Ag, at a P80 of 150 µm. The majority of the samples gave silver recoveries of 88% to 90%, with 50 kg/t Ag in the final concentrate. As with Loma de La Plata and Barite Hill, there was a close correlation between silver and copper plus lead in the concentrates.

Acanthite/argentite accounts for 90% of the silver in the concentrates, 2% as native silver and the balance as unidentified silver minerals.

As with Barite Hill, the tailings from the flotation tests showed poor settling (liquids-solids separation) characteristics and this will require more detailed investigation.

The chemical analysis of the concentrate is shown in Table 0.18, and the same comments apply as for Barite Hill.

16.3.6 Conclusions and recommendations

The test work on Loma de La Plata undertaken by the metallurgical laboratories has confirmed that the material tested responds well to flotation, with high recoveries and concentrate grades. A simple crushing, grinding and single product flotation concentrator is suggested.

The concentrates produced in the test work contained high silver values (around 50 kg/t Ag), with a combined base metals (copper plus lead) content of 15% to 25%. Preliminary discussion suggests that this should be readily saleable to base metals smelters.

The work on Loma de La Plata involving a number of composites prepared from fresh drill core is probably sufficient to support a Feasibility Study. A large quantity of core has been kept in sealed bags and is sufficient for a pilot plant test should this be considered necessary.

The test work on Barite Hill and Valle Esperanza has generally yielded satisfactory results, and as with Loma de La Plata, silver recoveries of 80% or better appear likely. The concentrate grades from Valle Esperanza are particularly high (over 50 kg/t Ag to 60 kg/t Ag), while those from Barite Hill are also satisfactory containing 20 kg/t Ag to 25 kg/t Ag.

Mr. Wells believes that Loma de La Plata, Barite Hill, and Valle Esperanza can all be treated in that same, simple, one product concentrator.

However it should be noted that the test work on Barite Hill and Valle Esperanza was much more limited than the Loma de La Plata test work programme, and did not use fresh drill core samples, but sample assay crushed rejects. Thus, more test work with new samples is essential to take Barite Hill and Valle Esperanza to Feasibility Study level. During this future work, more tailings samples should be taken for detailed solids liquids separation test work, probably requiring specialist laboratories with equipment vendors. Furthermore, concentrate samples should be taken to review the arsenic and antimony contents, as well as any other potential penalty elements. A more detailed evaluation of the market for silver/copper concentrates is required during the Prefeasibility Study.

17 Mineral Resource and Mineral Reserve estimates

Information in this section has been sourced from Snowden (2009).

17.1 Disclosure

Mineral Resources reported in Section 17 were prepared by Ms. P. De Mark, a Senior Consultant of Snowden and a Qualified Person as defined under NI 43-101. Documentation of the work was reviewed by Mr. I. Jones, Senior Principal Consultant for Snowden's Perth office.

Snowden is independent of Pan American.

Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. No Mineral Reserves are reported in this Technical Report.

This report uses definitions from and follows the guidelines of the CIM Definition Standards for Mineral Resources and Mineral Reserves and NI 43-101 Form F1. The Project has no mine design or defined economic parameters at this stage.

17.1.1 Known issues that materially affect the Mineral Resources

In 2006 the government of Chubut Province decreed a three year moratorium on all mining activities, including exploration, in the western part of the Province. This moratorium is due to expire on 29 June 2009, and the government of Chubut has publicly declared that it intends to extend the moratorium for another three years. The government asserts this is to enable the completion of a province-wide map of the mineral potential. The Navidad Property lies outside of and to the east of these "no-mining" zones. The government of Chubut Province has also decreed a Province-wide ban on the use of cyanide for mining purposes and the development of open pit mines. The law states that the government of Chubut Province will accept and review mining proposals, including open pit and cyanide based mining operations, on a case by case basis and determine at that point whether permits may be issued.

The Supreme Court of British Columbia awarded ownership of the Navidad Project to Minera Aquiline on 14 July 2006 following a court case with IMA Exploration Inc. (IMA) where IMA was found to have breached a Confidentiality Agreement with Minera Normandy Argentina S.A. (Minera Normandy), then a subsidiary of Newmont Mining Corporation. Minera Normandy was subsequently acquired by Aquiline and its name was changed to Minera Aquiline. IMA appealed the trial court decision to the Appeal Court of British Columbia which denied the appeal in reasons for judgment dated 7 June 2007. In September 2007 IMA submitted an Application for Leave to Appeal to the Supreme Court of Canada. Sole ownership rights were granted to Aquiline by the Supreme Court of Canada on 20 December 2007, subject to Aquiline making payment to IMA which would reimburse the latter for its accrued exploration expenditures up to the July 2006 court decision. Aquiline's final payment to IMA was made on 8 February 2008 giving Aquiline full ownership of the Project.

Snowden is unaware of any other issues that may materially affect the Mineral Resources in a detrimental sense. These conclusions are based on the following:

— The Pan American exploration license has an approved environmental operating license.

— Pan American has represented that the material mineral and surface rights have secure title.

— There are no known marketing, political, or taxation issues.

— Pan American has represented that the Project has local community support.

— There are no known infrastructure issues.

17.2 Assumptions, methods and parameters – 2009 Mineral Resource estimates

Mineral Resource estimates were prepared in the following steps:

— Data validation was undertaken by Aquiline and reviewed by Snowden.

— Data preparation, including importation to various software packages.

— Analysis of the QAQC data.

— Geological interpretation and modelling of lithological and mineralisation domains was by Snowden based on interpretations provided by Aquiline.

— Coding of drillhole data within mineralised grade estimation domains.

— Samples were composited to 3 m lengths.

— Exploratory data analysis of silver and lead grades based on mineralised domains, and also of copper at Loma de La Plata.

— Indicator variogram analysis and modelling.

— Derivation of kriging plan and boundary conditions.

— Creation of block models and application of density values by domain.

— Grade estimation of Ag and Pb (and Cu at Loma de La Plata) into blocks using multiple indicator kriging (MIK).

—

Grade estimation of Ag and Pb (and Cu at Loma de La Plata) into blocks using ordinary kriging (OK) and nearest neighbour (NN) for MIK estimation validation.

— Validation of estimated block grades against input sample composite grades.

— Confidence classification of estimates with respect to CIM guidelines.

— Resource tabulation and Resource reporting.

17.3 Supplied data, data preparation, data transformations, and data validation

17.3.1 Supplied data

Aquiline provided raw drillhole data in Access database format, geological and mineralisation models and surface topography data in AutoCAD DXF format, specific gravity measurements in Microsoft Excel format, and relevant technical documentation.

17.3.2 Data preparation

Snowden prepared desurveyed drillholes from collar, survey, lithology, and assay data provided by Aquiline. A location map showing drillholes available for the April 2009 Mineral Resource estimate is shown in Figure 17.1. The number of drillholes used in the

Navidad April 2009 Mineral Resource estimate is shown in Table 17.1. A list of the collar locations is given in Appendix A.

Figure 17.1 Location map of drillholes available in the April 2009 Navidad database

Table 17.1 Number of drillholes used in the Navidad 2009 Mineral Resource estimates

Area	Number of drillholes	Metres of drilling
Calcite NW	111	16,440
Calcite Hill	81	14,973
Navidad Hill	105	12,394
Connector Zone	75	12,394
Galena Hill	92	17,221
Barite Hill	56	12,832
Loma de La Plata	210	45,918
Valle Esperanza	70	23,702
Total	800	155,872

17.3.3 Data transformations

The drilling pattern is oriented to the northeast-southwest on the Gauss Kruger Zone 2 projection, relative to the Campo Inchauspe datum, except at Loma de La Plata, where the drilling pattern is oriented to the east-west. Aquiline applied a correction to the magnetic value recorded in downhole surveys to convert from magnetic to the Gauss Kruger grid and provided Snowden with the final azimuth data. Snowden converted the downhole dip to conform to Datamine convention (downward direction holes are indicated with a positive dip sign).

Snowden assigned values of half the detection limit of assays for Ag, Pb, and Cu to unsampled drillhole intervals (usually at the drill collar), to prevent smearing of sampled grades into unsampled intervals. The values applied to the unsampled intervals were 0.5 g/t Ag, 0.005% Pb, and 0.005% Cu.

No other transformations or rotations have been performed by Snowden on the data or models.

17.3.4 Data validation

Validation checks in Datamine mining software included searches for overlaps or gaps in sample and geology intervals, inconsistent drillhole identifiers, and missing data. No errors were noted.

Aquiline also provided Snowden with sample assay quality assurance/quality control (QAQC) data for review. Analysis of QAQC data is used to assess the reliability of sample assay data and the confidence in the data used for the resource estimation. The results of the QAQC analyses are discussed in Section 13.2.

17.4 Geological interpretation, modelling, and domaining

17.4.1 Geological interpretation and modelling

Snowden updated the 2007 geological interpretation to include recent drilling information, based on geological wireframes provided by Aquiline. Snowden created new digitised geological interpretations for Valle Esperanza, which had no previous geological interpretation, also based on geological wireframes provided by Aquiline. Three wireframes of north-northwest trending faults were provided by Aquiline, which were used to truncate mineralisation to the west of Galena Hill. Snowden recommends that Pan American continue with modelling fault interpretations, for use in future resource estimations.

The geological interpretations were digitised on section and wireframed into lithological domains representing mudstone/limestone, conglomerate, latite, and volcaniclastic contacts. Mineralised domains were digitised around continuous areas of mineralisation generally greater than 25 g/t Ag and/or 1% Pb.

No model of the oxidation surface has yet been prepared, as generally there is no well developed oxidation zone present in the respective deposits except for a mixed zone comprised mostly of sulphides with oxidation along fractures. Recent metallurgical test work has suggested that oxidation may play a more important role in mineral processing than previously known. Staff geologists will be undertaking a more diligent study of the differences between the oxide and sulphide zones for modelling in future resource estimations.

17.4.2 Definition of grade estimation domains

Grade estimation domains, which are subdivisions of the geological model and represented by subsets of the sample data, ensure that samples used for estimating a block grade are from the same population as the point of estimation. A grade population may be defined by attributes such as spatial location, lithology, mineralisation style, and structural boundaries.

The Navidad Mineral Resources have been estimated and reported individually for each deposit, including Calcite NW, Calcite Hill, Navidad Hill, Connector Zone, Galena Hill, Barite Hill, Loma de La Plata, and Valle Esperanza.

Data for each deposit has been further divided into sub-domains according to lithological unit (mudstone/limestone, latite, conglomerate, and volcaniclastic units) and strength of mineralisation (high or low). An example of the estimation domains at Loma de La Plata is shown in Table 17.2. The estimation domains for the remaining deposits are shown in Appendix B.

Table 17.2 Loma de La Plata estimation domains

Deposit	Lithology	Mineralisation	Domain code
Loma de La Plata	Conglomerate	Low grade	715
	Mudstone	Low grade	725
	Mudstone	High grade	726
	Latite	Low grade	735
	Latite	High grade	736

17.5 Sample statistics

17.5.1 Sample compositing

Sample lengths were composited to ensure that the samples used in statistical analyses and estimations have similar support (i.e., length). Aquiline sampled drillholes at various interval lengths depending on the length of intersected geological features, and in geologically similar units, select samples at 3 m lengths. Sample lengths were examined for each deposit and composited to 3 m according to the most frequently sampled length interval (3 m). 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 mineralised domain boundaries). The COMPDH parameter MODE was set to a value of 1 to allow adjusting of the composite length while keeping it as close as possible to the composite interval (3 m); this is done to minimise sample loss, and to ensure equal sample support.

17.5.2 Extreme value treatment

No top cuts of extreme values were applied to the input samples used in the MIK estimation, as the extreme values in the high grade mineralised domains are well supported by other extreme values, and are not the sole cause of the grade variability in the domain population. An example log histogram of input sample composites from the high grade latite estimation domain at Loma de La Plata is shown in Figure 17.2, log histograms of input sample composites for the high grade estimation domains at the remaining deposits are shown in Appendix C. Extreme grade values are treated in the estimate using multiple indicator kriging.

Figure 17.2 Log histogram of Loma de La Plata undeclustered sample composites in Domain 736

17.5.3 Data declustering

Descriptive statistics of sample populations within a domain may be biased by clustering of sample data in particular areas of the domain. At the Navidad deposits, because of the orientation and spacing of the drillholes oblique to the Project coordinates (on the Gauss Kruger projection, Zone 2, relative to the Campo Inchauspe datum), the input sample data statistics are strongly influenced by the dimensions of the orthogonal declustering grid. To reduce any bias caused by clustering of sample data, Snowden declustered the input sample data by making a nearest neighbour estimate into the MIK block model. Declustered data statistics are considered during the selection of the grade interpolation method and used when comparing estimated grades and input sample grades during model validation.

17.5.4 Input sample statistics

Declustered statistics for sample composites in each of the domains within the classified resource area are shown for Ag in Appendix D and for Pb in Appendix E. Example statistics for Loma de La Plata are shown Table 17.3 for Ag, Table 17.4 for Pb, and Table 17.5 for Cu. Mineralisation is associated with the mudstone and latite domains although minor occurrences of mineralised conglomerate and volcaniclastic rocks are present. High CV values and examination of the sample histogram suggest mixed populations within most domains. Grade estimation domains may be refined after collection of additional drillhole samples and analysis of grade distributions.

Table 17.3 Declustered composite sample input statistics for Ag at Loma de La Plata

Deposit	Domain	Number of composites	Min (g/t)	Max (g/t)	Mean (g/t)	CV
Loma de La Plata	715	1,504	0.5	23	1	1.5
	725	5,585	0.5	66	1	1.9
	726	238	0.5	213	23	1.1
	735	4,916	0.5	84	2	1.9
	736	1,802	0.5	5,407	125	2.7

Table 17.4 Declustered composite sample input statistics for Pb at Loma de La Plata

Deposit	Domain	Number of composites	Min (%)	Max (%)	Mean (%)	CV
Loma de La Plata	715	1,504	0.01	1.69	1.69	2.6
	725	5,585	0.01	1.74	1.74	2.1
	726	238	0.01	3.23	3.23	1.1
	735	4,916	0.01	2.28	2.28	3.3
	736	1,802	0.01	3.54	3.54	2.8

Table 17.5

Declustered composite sample input statistics for Cu at Loma de La Plata

Deposit	Domain	Number of composites	Min (%)	Max (%)	Mean (%)	CV
Loma de La Plata	715	1,504	0.01	0.04	0.01	0.5
	725	5,585	0.01	0.18	0.01	1.0
	726	238	0.01	0.24	0.02	1.8

Deposit	Domain	Number of composites	Min (%)	Max (%)	Mean (%)	CV
	735	4,916	0.01	0.28	0.01	1.2
	736	1,802	0.01	1.30	0.05	1.8

17.6 Variography

Variography was undertaken by grade estimation domain for each deposit. To improve variogram quality in the grade estimation domains at the Navidad Trend (Calcite NW, Calcite Hill, Navidad Hill, Connector Zone, Galena Hill, and Barite Hill), sample composites of the grade estimation domain for the deposit under consideration were combined with sample composites from corresponding grade estimation domains from the two deposits lying immediately to the northwest and southeast. For example, sample composites for the high grade latite estimation domain for Galena Hill were combined with high grade latite sample composites from Connector Zone to the northwest and Barite Hill to the southeast.

17.6.1 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. As the mineralised domain has a long, wide, and relatively flat shape oriented to the northwest, only orientations close to the plane of the domain were considered.

Indicator variograms were defined at percentile intervals chosen by grade estimation domain to best represent the grade distribution. Horizontal, across strike, and dip plane continuity directions for each domain were chosen by examining indicator variogram maps and their underlying variograms for Ag and Pb, and Cu at Loma de La Plata, rotated onto the plane of the mineralised domain.

17.6.2 Variogram modelling

Directional variograms were modelled for the three principal directions for Ag and Pb, and Cu at Loma de La Plata, based on the directions chosen from the variogram fans.

Variogram parameters at the 95th decile are detailed in Table 17.6 for Ag, Table 17.7 for Pb, and Table 17.8 for Cu.

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Table 17.6 95th decile variogram model parameters for Ag

Domain	Rotation 1 (Z axis)	Rotation 2 (X axis)	Rotation 3 (Z axis)	C0§	C1§	Ranges (m)†	C2§	Ranges (m)†	C3§	Ranges (m)†
Navidad Trend 15	210	15	0	0.37	0.17	120,90,40	0.46	130,120,55	-	-
Navidad Trend 25	210	15	0	0.47	0.14	100,40,19	0.19	190,60,20	0.2	200,80,30
Navidad Trend 26	210	15	0	0.45	0.2	30,30,5	0.35	50,50,10	-	-
Navidad Trend 35	210	15	0	0.5	0.2	20,30,16	0.18	30,40,32	0.12	120,50,33
Navidad Trend 36	210	15	0	0.4	0.1	10,20,7	0.22	20,30,45	0.28	40,35,50
Navidad Trend 45	210	15	0	0.42	0.58	70,65,35	-	-	-	-
715	80	20	0	0.72	0.17	110,50,14	0.11	120,100,15	-	-
725	60	30	90	0.4	0.6	450,220,30	-	-	-	-
726	60	30	70	0.6	0.4	50,50,6	-	-	-	-
735	80	20	80	0.4	0.3	40,110,7	0.3	50,115,45	-	-
736	80	20	80	0.6	0.16	30,30,10	0.24	50,50,11	-	-
815	30	10	0	0.42	0.58	270,180,54	-	-	-	-
825	50	20	20	0.47	0.53	200,200,40	-	-	-	-
835	10	20	0	0.47	0.26	90,125,11	0.27	140,150,30	-	-
836	10	30	0	0.5	0.14	50,80,16	0.36	100,120,17	-	-

Note: § variances have been normalised to a total of one; † ranges for major, semi-major, and minor axes, respectively; structures two and three are modelled with a spherical model

Table 17.7 95th decile variogram model parameters for Pb

Domain	Rotation 1 (Z axis)	Rotation 2 (X axis)	Rotation 3 (Z axis)	C0§	C1§	Ranges (m)†	C2§	Ranges (m)†
Navidad Trend 15	210	15	0	0.27	0.33	165,210,12	0.4	170,240,18
Navidad Trend 25	210	15	0	0.46	0.13	110,50,15	0.41	150,80,17

Domain	Rotation 1 (Z axis)	Rotation 2 (X axis)	Rotation 3 (Z axis)	C0§	C1§	Ranges (m)†	C2§	Ranges (m)†
Navidad Trend 26	210	15	0	0.55	0.45	50,40,10	-	-
Navidad Trend 35	210	15	0	0.4	0.18	140,180,7	0.42	190,250,50
Navidad Trend 36	210	15	0	0.3	0.2	40,50,4	0.5	140,70,14
Navidad Trend 45	210	15	0	0.2	0.8	110,75,18	-	-
715	50	20	30	0.5	0.2	120,220,8	0.3	150,250,14
725	70	20	60	0.3	0.06	90,60,18	0.34	130,180,300
726	60	30	50	0.54	0.46	75,80,12	-	-
735	70	20	80	0.32	0.29	400,63,7	0.39	460,370,15
736	40	20	70	0.4	0.33	360,340,10	0.27	400,350,20
815	30	15	0	0.26	0.26	100,50,3	0.48	350,260,34
825	40	15	0	0.38	0.08	10,40,9	0.2	150,175,16
835	30	10	40	0.35	0.09	50,50,2	0.05	80,120,10
836	40	50	140	0.46	0.24	40,40,8	0.3	80,110,13

Note: § variances have been normalised to a total of one; † ranges for major, semi-major, and minor axes, respectively; structures two and three are modelled with a spherical model

Table 17.8 95th decile variogram model parameters for Cu

Domain	Rotation 1 (Z axis)	Rotation 2 (X axis)	Rotation 3 (Z axis)	C0§	C1§	Ranges (m)†	C2§	Ranges (m)†
715	40	20	90	0.45	0.3	60,110,8	0.25	80,120,13
725	60	20	100	0.5	0.26	90,90,15	0.24	100,150,20
726	70	20	80	0.45	0.55	100,50,8	-	-
735	70	20	60	0.32	0.21	180,240,6	0.1	250,250,38
736	80	20	40	0.36	0.19	40,30,6	0.45	80,70,10

Note: § variances have been normalised to a total of one; † ranges for major, semi-major, and minor axes, respectively; structures two and three are modelled with a spherical model

17.7 Estimation parameters

17.7.1 Kriging parameters

A kriging neighbourhood analysis (KNA) was performed to determine the optimum kriging parameters. KNA is the process of undertaking multiple ordinary kriged estimates using a variety of block sizes and search neighbourhood parameters (such as minimum and maximum sample numbers) and comparing the slope of regression, kriging efficiency, and kriging variance values produced from the estimates1. Kriging parameters were selected through examination of the results of the estimates in terms of slope of regression, kriging efficiency, kriging variance, and Snowden's experience with similar deposits.

17.7.2 Block size selection

Block sizes were selected according to the average drillhole spacing, the results of the KNA and the dimensions of the mineralised envelopes. Snowden created block models with dimensions of 12.5 m Easting, 12.5 m Northing, and 5 m Elevation, except at Barite Hill, where the block models had blocks with dimensions of 25 m Easting, 25 m Northing, and 5 m Elevation, based on the wider spacing of drillholes at Barite Hill.

17.7.3 Sample search parameters

The following search strategy was selected based on the results of the KNA:

— Search range equal to the maximum variogram range.

— A minimum of 10 samples per estimate.

— A maximum of 32 samples per estimate.

— Maximum of three samples per borehole.

Three search ellipses were employed. A second search equal to 1.5 times the maximum variogram range 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 two times the maximum variogram range was used. If the minimum number of samples required were not encountered in the third search, no estimate was made.

17.7.4 Block model set up

Table 17.9 gives the block model parameters for the Navidad Mineral Resource models.

Table 17.9 Navidad block model parameters

Deposit	Direction	Minimum	Maximum	Increment (m)
Calcite NW	Easting	2,512,100	2,514,100	12.5
	Northing	5,304,600	5,306,100	12.5
	Elevation	800	1,300	5

1 Krige (1996) considers that kriging efficiency (KE) and regression slope (R) can be used to establish confidence in block estimates. KE=(BV-KV)/BV and R=(BV-KV)+ μ)/(BV-KV+ 2μ), where BV = the theoretical variance of blocks within the domain (block variance), KV = the variance between the kriged grade and the true (unknown) grade (kriging variance), and μ = LaGrange multiplier obtained from kriging. A perfect estimation would return KV=0, KE=100%, and R=1.

Deposit	Direction	Minimum	Maximum	Increment (m)
Calcite Hill	Easting	2,513,800	2,514,700	12.5
	Northing	5,304,400	5,305,200	12.5
	Elevation	900	1,250	5
Navidad Hill	Easting	2,514,200	2,515,000	12.5
	Northing	5,304,100	5,304,900	12.5
	Elevation	900	1,250	5
Connector Zone	Easting	2,514,600	2,516,000	12.5
	Northing	5,303,900	5,304,525	12.5
	Elevation	700	1,250	5
Galena Hill	Easting	2,515,200	2,516,300	12.5
	Northing	5,303,000	5,304,300	12.5
	Elevation	700	1,200	5
Barite Hill	Easting	2,516,000	2,517,200	25
	Northing	5,302,300	5,303,400	25
	Elevation	700	1,200	5
Loma de La Plata	Easting	2,509,700	2,512,700	12.5
	Northing	5,302,600	5,303,900	12.5
	Elevation	700	1,700	5
Valle Esperanza	Easting	2,513,000	2,516,300	12.5
	Northing	5,302,000	5,304,900	12.5
	Elevation	500	1,300	5

17.7.5 Grade interpolation and boundary conditions

Grade interpolation was undertaken in the selected grade percentile bins for each grade estimation domain using MIK. This interpolation method was selected in preference to ordinary kriging to represent the mixed populations in the grade estimation domains and to restrict the effect of extreme grade values, while honouring the extreme grade values present due to the style of mineralisation. Domain boundaries were treated as hard boundaries, so that samples lying in one domain were not used in the estimation of another, to prevent the smearing of grades from one domain to another.

Ordinary kriged estimates were also performed to assist with optimising the grade estimation parameters and to assist with resource confidence classification by writing the kriging efficiency, kriging variance, and regression slope to the OK model. A nearest neighbour estimate was also undertaken to assist with estimation validation.

17.8 Specific gravity

Specific gravity values were applied by domain to the block model. Table 0.10 gives statistics of the density determinations for each of the domains, and the mean value assigned to the block models.

Table 17.10 Navidad block model densities

Description	Domain	Count	Min	Max	Mean	CV
Unmineralised conglomerate	115	27	2.18	2.66	2.45	0.07
	215	4	2.43	2.56	2.49	0.03
	315	28	2.21	3.46	2.48	0.09
	615	149	2.03	2.58	2.32	0.04
	715	352	2.13	2.85	2.59	0.04
	815	196	2.22	2.70	2.46	0.04
Unmineralised mudstone/limestone	125	547	1.03	4.02	2.47	0.08
	225	123	2.07	3.18	2.46	0.07
	325	151	2.05	3.32	2.44	0.07
	425	56	1.98	2.65	2.36	0.06
	525	505	1.89	2.78	2.29	0.05
	625	648	1.10	3.59	2.28	0.08
	725	802	2.08	3.00	2.56	0.05
	825	182	1.76	2.96	2.46	0.06
Mineralised mudstone/limestone	126	163	2.04	3.67	2.50	0.08
	226	62	1.94	3.17	2.50	0.10
	326	65	2.12	2.78	2.44	0.05
	426	106	1.95	2.99	2.42	0.07
	526	184	1.87	3.04	2.41	0.07
	626	499	1.56	2.95	2.28	0.06
	726	104	1.87	4.18	2.62	0.09
Unmineralised latite	135	202	1.03	4.02	2.52	0.09
	235	148	2.11	3.19	2.43	0.06
	335	205	1.91	2.76	2.41	0.05
	435	211	2.15	2.93	2.51	0.05
	535	424	2.13	4.25	2.53	0.07
	635	304	2.00	2.88	2.38	0.06
	735	1,564	1.88	4.28	2.61	0.06
	835	777	2.18	3.99	2.55	0.05
Mineralised latite	136	105	2.04	3.45	2.52	0.08
	236	1,587	1.94	3.86	2.53	0.09

336	352	1.95	3.34	2.39	0.06
436	769	1.97	3.90	2.59	0.08
536	1,204	1.88	3.92	2.58	0.06
636	69	2.23	2.69	2.39	0.04

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Description	Domain	Count	Min	Max	Mean	CV
	736	970	1.79	3.86	2.61	0.06
	836	172	2.32	3.71	2.56	0.06
Unmineralised volcaniclastic	145	26	2.36	3.83	2.61	0.11
	245	44	1.90	2.58	2.38	0.05
	345	19	2.30	2.77	2.48	0.06
	445	41	2.23	3.20	2.46	0.06
	545	137	1.98	2.70	2.43	0.06
	645	23	2.37	2.63	2.48	0.03

17.9 Estimation validation

Snowden validated the Navidad models using four techniques:

- Comparison of global mean declustered sample statistics with the mean estimated grade by domain.
- Visual inspection of block and sample composite grades in section, plan, and in three dimensions.
- Generation of slice validation plots of declustered sample composite grades with estimated block grades by domain, to compare sample and estimated grade trends.
- Comparison to previous estimates, where possible.

17.9.1 Domain statistics and visual validation

Snowden validated the Navidad models by comparing the estimated grades by domain for each deposit with the declustered input samples. Snowden used a nearest neighbour estimate, which does a basic decluster of the input data into a grid defined by the block model, to make a direct comparison between the estimated mean grade values and the sample input data. Examples of the comparison between estimated and input data grades for Loma de La Plata are shown in Table 0.11 for Ag, Table 0.12 for Pb, and Table 0.13 for Cu. The comparisons for the other deposits are shown in Appendix F for Ag and in Appendix G for Pb.

Global grade comparisons are within acceptable tolerances for most mineralised domains; for low grade and poorly sampled domains the percentage difference between input samples and estimated grades may be high. Because the nearest neighbour estimate uses a single sample to return a grade value to the block cell, global grade differences between the nearest neighbour and the MIK model, which uses between 10 and 32 samples to estimate block grades, may also be high. The global grade difference may be particularly high if the composite closest to the block cell happens to have an extreme grade value.

Areas with poor comparisons between estimated and input grades were examined again in detail in section and three dimensions. Snowden found that the distribution of estimated grades corresponds to the distribution of grades in the input data, and the grades are continuously distributed. The largest differences also appeared to be related to the sample support for the estimates and the declustering and location of the data.

Table 17.11 Comparison of estimated and input data Ag grades by domain

Deposit	Domain	Estimated grade (Ag g/t)	Declustered input grade (Ag g/t)	% difference
Loma de La Plata	715	1	1	0
	725	1	1	0
	726	21	23	-8
	735	2	2	0
	736	126	125	0

Table 17.12 Comparison of estimated and input data Pb grades by domain

Deposit	Domain	Estimated grade (Pb%)	Declustered input grade (Pb%)	% difference
Loma de La Plata	715	0.03	0.03	0
	725	0.03	0.03	0
	726	0.33	0.35	5
	735	0.03	0.04	-14
	736	0.10	0.12	-15

Table 17.13 Comparison of estimated and input data Cu grades by domain

Deposit	Domain	Estimated grade (Cu%)	Declustered input grade (Cu%)	% difference
Loma de La Plata	715	0.01	0.01	0
	725	0.01	0.01	0
	726	0.02	0.02	0
	735	0.01	0.01	0
	736	0.05	0.05	0

17.9.2 Slice validation plots

Validation plots of estimated block grades and input sample data were made for all domains for Ag and Pb (and for Cu at Loma de La Plata) on easting, northing, and elevation. Estimated block grades generally correspond to input sample grades with the expected degree of smoothing from the kriging interpolation.

17.9.3 Comparison with previous estimates

Mineral Resources at Navidad have been previously reported (Snowden 2006a, Snowden 2006b, and Snowden 2007) for Calcite NW, Calcite Hill, Navidad Hill, Connector Zone, Galena Hill, Barite Hill, and Loma de La Plata. Mineral Resources have not been previously reported for Valle Esperanza. New drillhole information available since reporting of the November 2007 Mineral Resource estimates is shown in Table 0.14.

Pan American Silver Corp:

Table 17.14 Additional drilling information since the November 2007 Mineral Resource estimates

Deposit	Number of drillholes available in the November 2007 estimates	Number of new holes available in the April 2008 estimates	% new drillholes
Calcite NW	100	16	15
Calcite Hill	75	6	7
Navidad Hill	104	0	0
Connector Zone	51	22	30
Galena Hill	85	17	18
Barite Hill	51	5	9
Loma de La Plata	53	150	72
Valle Esperanza	0	75	100

The additional drilling since the November 2007 Mineral Resource estimates has resulted in the following changes to the April 2009 estimate:

— Updated geological and mineralised envelope interpretation, including the introduction of a new lithological domain (conglomerate/greywacke Domain 15).

— Top cuts previously applied to extreme grade values in the input sample data for some grade estimation domains have been removed, as additional drillhole sample data have supported the existing extreme grade values.

— Variography has been reinterpreted with the updated drilling, with an increased nugget and ranges remaining similar to previous estimates.

— Density values have been updated with additional specific gravity information.

— Application of a new AgPb equivalence formula (AgEQ = Ag + (Pb*10,000/365)) based on updated silver and lead prices using three year rolling average prices for silver ($12.52 per oz) and an approximate ten year rolling average for lead ($0.50 per lb).

— An increase in Mineral Resource tonnes and, in places, shifting of tonnage from the Inferred Resource classification to the Indicated Resource classification. The shift in tonnes from one category to the next has resulted in a corresponding shift of grades, usually manifested in a shift of higher grades to a higher level of confidence, and vice versa.

The superseded November 2007 Mineral Resource estimates above a 50 g/t Ag equivalent value using the new AgPb equivalence formula (AgEQ (g/t) = Ag (g/t) + (Pb(%)*10,000/365)) are shown in Table 0.15.

Pan American Silver Corp:

Table 17.15 Superseded November 2007 Mineral Resource estimates reported above a 50 g/t Ag equivalent cut-off (AgEQ = Ag + (Pb*10,000/365))

Deposit	Classification	Tonnes (Mt)	AgEQ g/t	Ag g/t	Pb%	Contained Ag (Moz)	Contained Pb (Mlb)
Calcite Hill NW	Measured	-	-	-	-	-	-
	Indicated	11.8	107	92	0.56	35	146
	Meas. + Ind.	11.8	107	92	0.56	35	146
	Inferred	6.7	72	51	0.78	11	115
Calcite Hill	Measured	-	-	-	-	-	-
	Indicated	13.9	126	106	0.72	47	221
	Meas. + Ind.	13.9	126	106	0.72	47	221
	Inferred	3.8	86	78	0.30	9	25
Navidad Hill	Measured	8.1	136	122	0.52	32	92
	Indicated	5.5	95	89	0.23	16	28
	Meas. + Ind.	13.5	120	109	0.40	47	119
	Inferred	2.6	91	81	0.36	7	21
Connector Zone	Measured	-	-	-	-	-	-
	Indicated	7.5	108	98	0.39	24	66
	Meas. + Ind.	7.5	108	98	0.39	24	66
	Inferred	3.1	115	105	0.34	11	24
Galena Hill	Measured	7.0	275	196	2.90	44	445
	Indicated	40.1	159	109	1.83	140	1619
	Meas. + Ind.	47.0	176	121	1.99	184	2064
	Inferred	6.0	135	102	1.20	20	160
Barite Hill	Measured	-	-	-	-	-	-
	Indicated	6.2	194	184	0.37	36	50
	Meas. + Ind.	6.2	194	184	0.37	36	50
	Inferred	0.4	80	44	1.29	1	11
Loma de La Plata	Measured	-	-	-	-	-	-
	Indicated	9.0	230	227	0.09	66	18
	Meas. + Ind.	9.0	230	227	0.09	66	18
	Inferred	17.2	163	160	0.11	88	42
Total	Measured	15.0	201	156	1.62	76	537

Indicated	94.0	149	120	1.04	364	2148
Meas. + Ind.	109.0	156	125	19.37	439	2685
Inferred	39.9	127	114	0.45	146	398

17.10 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 mineralisation)
- Estimation quality

17.10.1 Geological continuity and understanding

Staff geologists log drill core in detail including textural, alteration, structural, mineralisation, and lithological properties, and continue to develop a good understanding of the geological controls on mineralisation. Confidence in geological continuity is good in most cases and could be increased by creating a geological interpretation incorporating all available geological information, including surface mapping, geophysical information, and core logging detail in digital, three dimensional format.

17.10.2 Data density and orientation

Aquiline drilled the Navidad deposits on a pattern roughly 50 m along strike, with closer spaced drilling in the Galena Hill and Navidad Hill areas. Geological confidence and estimation quality are closely related to data density and this is reflected in the classification of Resource confidence categories.

17.10.3 Data accuracy and precision

Classification of Resource confidence categories are 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.

At Navidad, as in most deposits, two important items to consider regarding data accuracy are the quality of the assay values and the specific gravity determinations. Field duplicate results indicate a level of precision that is within a normal range for such a deposit. Potential errors with the specific gravity determination methods in use at the Navidad Project have been discussed in Snowden (2007) and in Section 12.3 of this Technical Report, and are being addressed by Pan American.

It is Snowden's opinion that the accuracy and precision of the assay and specific gravity data, as defined by the QAQC and analysis of the methods used to measure the data, is acceptable for use in resource estimation. The confidence in the data is sufficient to support the assigned classifications of the Navidad resources.

17.10.4 Spatial grade continuity

Spatial grade continuity, as indicated by the variogram, is an important consideration when assigning Resource confidence 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. At the Navidad deposits the variogram nugget effect for both Ag and Pb is on average a high proportion of the total population variance. In some cases, due to the characteristics of the data, confidence in the model of spatial continuity may be low. In some grade estimation domains, it was not possible to calculate reliable variograms, and variogram models from similar domains were "borrowed" for these domains. These factors have been considered while assigning Resource confidence classification categories.

17.10.5 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.

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

17.10.6 Classification process

The Mineral Resource confidence classification of the Navidad Mineral Resource models incorporated the confidence in the drillhole data, the geological interpretation, geological continuity, data density and orientation, spatial grade continuity, and estimation quality. The Resource models were coded for Inferred, Indicated, and Measured categories according to CIM Standards. The process for classification is as follows:

— A three dimensional perimeter around three dimensionally continuous blocks containing estimates created during the first search ellipse was created, and the blocks within the perimeter coded as Inferred.

— A three dimensional perimeter around three dimensionally continuous blocks containing kriging efficiencies greater than 40 were coded as Indicated.

— A three dimensional perimeter around three dimensionally continuous blocks containing kriging efficiencies greater than 60 were coded as Measured. Not all deposits have Measured Mineral Resources.

— A surface representing the base of drilling was created, and all blocks below this base were coded as unclassified.

— A perimeter representing the lateral extent of the drilling was created, and expanded by 25 m and 50 m. Any blocks outside of the 50 m perimeter were coded as unclassified. Any blocks outside of the 25 m perimeter were coded as Inferred. The effect of this process is to restrict the confidence classification in the dip direction, which has a less regular pattern of drilling and often does not define the down dip boundary of mineralisation (in other words, mineralisation remains open, and Mineral Resources may be increased through additional drilling).

17.11 Mineral Resource reporting

Mineral Resource estimates are reported for the Calcite NW, Calcite Hill, Navidad Hill, Connector Zone, Galena Hill, Barite Hill, Loma de La Plata, and Valle Esperanza deposits at the Navidad Property (Table 0.16). Tonnes and grades have been reported above a cut-off grade of 50 g/t silver equivalent. To date, no analysis has been made to determine the economic cut-off grade that will ultimately be applied to the Navidad Project. Silver equivalence was calculated using three year rolling average prices for silver ($12.52 per oz) and an approximate ten year rolling average price for lead ($0.50 per lb). The following formula, which does not include any other factors such as variable metal recoveries, was applied to reach the silver equivalent value:

AgEQ (g/t) = Ag (g/t) + (Pb (%) × 10,000/365)

No Mineral Reserves have been estimated at this time. Additional studies will be required to determine technical, economic, legal, environmental, socio-economic, and governmental factors. These modifying factors are normally included in a mining feasibility study and are a pre-requisite for conversion of Mineral Resources to, and reporting of, Mineral Reserves. The CIM Standards (CIM, 2005) describe completion of a Preliminary Feasibility Study as the minimum prerequisite for the conversion of Mineral Resources to Mineral Reserves.

The Navidad April 2009 resources are shown above a cut-off grade of 50 g/t silver equivalent using the silver equivalent formula utilised for reporting the November 2007 resource estimates in Appendix H. The silver equivalence was calculated using a silver price of US$10.00/oz and a lead price of US$0.70/lb to derive an equivalence formula of AgEQ (g/t) = Ag (g/t) + (Pb (%) × 10,000/208).

Tabulations of the April 2009 Mineral Resources above a 1 oz Ag per tonne cut-off are shown in Appendix I, and above a 50 g/t Ag cut-off in Appendix J.

Grade-tonnage curves of the Navidad April 2009 Mineral Resources above a range of silver equivalent values (AgEQ (g/t) = Ag (g/t) + (Pb (%) × 10,000/365)) are shown in Appendix K.

Pan American Silver Corp:

T a b l eNavidad April 2009 Mineral Resources reported above a cut-off grade of 17.16 50 g/t AgEQ

Deposit	Classification	Tonnes (Mt)	AgEQ g/t	Ag g/t	Pb%	Cu%	Contained Ag (Moz)	Contained Pb (Mlb)	Contained Cu (Mlb)
Calcite Hill NW	Measured	-	-	-	-	-	-	-	-
	Indicated	14.8	94	78	0.59	-	37	194	-
	Meas. + Ind.	14.8	94	78	0.59	-	37	194	-
	Inferred	14.6	74	52	0.82	-	24	265	-
Calcite Hill	Measured	-	-	-	-	-	-	-	-
	Indicated	17.5	115	100	0.55	-	56	212	-
	Meas. + Ind.	17.5	115	100	0.55	-	56	212	-
	Inferred	4.9	106	96	0.36	-	15	39	-
Navidad Hill	Measured	8.4	122	109	0.46	-	29	85	-
	Indicated	5.6	96	90	0.24	-	16	29	-
	Meas. + Ind.	14	112	101	0.37	-	45	114	-
	Inferred	1.8	81	70	0.41	-	4	16	-
Connector Zone	Measured	-	-	-	-	-	-	-	-
	Indicated	8.2	102	91	0.41	-	24	74	-
	Meas. + Ind.	8.2	102	91	0.41	-	24	74	-
	Inferred	9.9	88	74	0.49	-	24	107	-
Galena Hill	Measured	7	242	170	2.62	-	38	404	-
	Indicated	44.7	166	117	1.78	-	168	1,754	-
	Meas. + Ind.	51.7	176	124	1.89	-	206	2,158	-
	Inferred	1.7	116	80	1.35	-	4	50	-

Pan American Silver Corp:

Deposit	Classification	Tonnes (Mt)	AgEQ g/t	Ag g/t	Pb%	Cu%	Contained Ag (Moz)	Contained Pb (Mlb)	Contained Cu (Mlb)
Barite Hill	Measured	-	-	-	-	-	-	-	-
	Indicated	7.7	161	153	0.28	-	38	48	-
	Meas. + Ind.	7.7	161	153	0.28	-	38	48	-
	Inferred	0.9	100	81	0.69	-	2	13	-
Loma de La Plata	Measured	-	-	-	-	-	-	-	-
	Indicated	29.1	172	169	0.09	0.05	158	58	33
	Meas. + Ind.	29.1	172	169	0.09	0.05	158	58	33
	Inferred	1.3	82	76	0.21	0.05	3	6	1
Valle Esperanza	Measured	-	-	-	-	-	-	-	-
	Indicated	12.2	178	172	0.21	-	68	56	-
	Meas. + Ind.	12.2	178	172	0.21	-	68	56	-
	Inferred	10.8	133	123	0.35	-	43	84	-
Total	Measured	15.4	177	137	1.44	-	67	489	-
	Indicated	139.8	147	126	0.79	0.05	565	2,425	33
	Meas. + Ind.	155.2	150	127	0.85	0.05	632	2,914	33
	Inferred	45.9	97	81	0.57	0.05	119	580	1

Notes:
The most likely cut-off grade for these deposits is not known at this time and must be confirmed by the appropriate economic studies.
Silver equivalent grade values are calculated without consideration of variable metal recoveries for silver and lead. A silver price of US$12.52/oz and lead price of US$0.50/lb was used to derive an equivalence formula of AgEQ (g/t) = Ag (g/t) + (Pb (%) × 10,000 / 365). Silver prices are based on a three-year rolling average and lead prices are based on an approximate ten year rolling average.
The estimated metal content does not include any consideration of mining, mineral processing, or metallurgical recoveries.
Tonnes, ounces, and pounds have been rounded and this may have resulted in minor discrepancies in the totals.
Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. No Mineral Reserves have been estimated.
The estimate of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant issues.

18 Other relevant data and information

Information in this section has been sourced from Snowden (2009).

For a detailed history of the ownership of the Navidad properties, the reader is referred to the Pan American website at www.panamericansilver.com, where documents may be downloaded pertaining to the decision handed down by the Supreme Court of British Columbia as well as the subsequent ruling made by the British Columbia Court of Appeal.

In October 2008, Aquiline filed a Preliminary Economic Assessment (PEA) of Loma de La Plata on SEDAR (Snowden, 2008). That assessment was based on the resource estimate produced in 2007, although copper and other minor elements were modelled as part of the PEA. No mining reserve was calculated for Loma at that time.

Based on a production rate of 10,000 tpd of ore, a silver price of $12.52/oz and a copper price of $3.23/lb (three year average prices), the study determined the Loma de La Plata Project has a net present value (NPV) pre-tax at 7.5% of US$135.6 million, an internal rate of return (IRR) of 22% and a 25 month payback period. The mine would produce on average 15 million ounces of silver per annum for 6.6 years at an average operating cash cost of $5.22/oz Ag, with peak production in the first year of up to 23 million ounces of silver.

Ore production from the first of two stages accounts for the first three years of production, at an average grade of 231 g/t Ag before declining to an average grade of 140 g/t Ag in the second stage mined from Year 4 onward. The stripping ratio for the first stage pit is less than 1:1. During the first stage, mining and processing costs are $4.75/oz Ag, increasing as the second stage is mined due to a higher strip ratio and lower grade.

Pre-production capital expenditures are estimated at $272.6 million, most of which supports a processing plant handling throughput of 10,000 tpd (3.65 Mtpa) capable of being expanded to 30,000 tpd at some later stage. Conventional flotation of Loma de La Plata ore is expected to achieve a recovery of 80% of Ag to produce a concentrate grading 50 kilograms silver per tonne of concentrate. An estimated 450 personnel will be required during mine construction and up to 342 during mine operations.

Snowden is not aware of any other relevant data or information concerning the Navidad properties to report.

19 Interpretation and conclusions

Information in this section has been sourced and updated from Snowden (2009).

On 14 October 2009, Pan American announced a friendly offer to acquire all of the issued and outstanding securities of Aquiline. On 7 December 2009, Pan American acquired approximately 85% of the issued and outstanding shares of Aquiline and extended its bid to 22 December 2009, and on that latter date, Pan American took up an additional approximately 7% of the issued and outstanding shares in the capital of Aquiline. Since the offer to acquire the Aquiline shares was accepted by holders of more than 90% of the Aquiline shares, on 23 December 2009, Pan American provided notice to the remaining shareholders of its intention to exercise its right to acquire the remaining issued and outstanding Aquiline shares pursuant to the compulsory acquisition provisions of the Business Corporation Act (Ontario). Pursuant to the compulsory acquisition, Pan American has been deemed to have acquired the balance of the Aquiline shares not already owned by it on or about 22 January 2010.

As a result of its acquisition of Aquiline, Pan American is required to file a technical report on the Navidad Project pursuant to NI 43-101. This Technical Report is prepared to fulfil this requirement and is based on information disclosed in the Technical Report filed on SEDAR by Aquiline on 2 June 2009, and dated May 2009, amended June 2009 (Snowden, 2009). There are no other material changes to the Navidad Project to report aside from the acquisition of Aquiline by Pan American.

The Navidad Project is an advanced stage silver-lead mineral exploration project located in Chubut Province, Argentina, and is owned by Pan American through its subsidiary, Aquiline, who in turn operates in Argentine through its Argentine entity Minera Argenta S. A.

The deposit areas at Navidad occur within a sedimentary package known as the Cañadón Asfalto Formation hosting an intermediate volcanic rock identified as trachyandesite, referred to locally as latite. Lithologies described as the Cañadón Asfalto may occur both above and below the intercalated bodies of latite. The entire sequence is interpreted to have been deposited within a lacustrine basin environment.

A group of eight individual deposits and six prospects have been identified at the project and seven of these have been the subject of previous Mineral Resource estimates (Snowden 2006a, Snowden 2006b, and Snowden, 2007). All of these deposits are either hosted in the latite unit itself or in the sedimentary sequence proximal to the latite. Base metals, principally lead and to a lesser extent copper, are typically present but are largely not significant in quantity except at Galena Hill. There has been virtually no gold detected to date.

Between the filing of the November 2007 Technical Report and the June 2009 Technical Report, additional geochemical and geophysical surveys plus 367 diamond drillholes totalling 92,540 m have been done on the Project. The geophysical surveys over the core area of the property have included gravity, deep-array pole-dipole IP, CSAMT, and a high definition ground magnetometer survey. At Navidad only the latter technique has shown some continued promise as an exploration guide through the interpretation of the detailed structural setting in the district.

The drilling programme continued to yield significant results during the 18 months prior to the June 2009 Technical Report, and of particular significance is the discovery of the Valle Esperanza deposit which in this estimate contains in the Indicated category

12.2 Mt at a grade of 172 g/t Ag, above a cut-off grade of 50 g/t AgEQ. In the Inferred category, the deposit contains 10.8 Mt at a grade of 123 g/t Ag above the same cut-off grade. The grade, geometry, and depth of this deposit are such that underground mining is a potential option.

Early metallurgical testing of Galena Hill has proved that differential flotation was effective in producing a lead concentrate and silver-rich concentrate, although it was recommended significant work was required to increase overall silver recovery and improve the quality of the concentrate for sale. Subsequent analysis of the pyrite concentrate mineralogy (XPS, 2007) identified the potential to upgrade the concentrate by inserting cleaning and entrainment controls into the circuit such as froth washing and column flotation, that improve concentrate grades by a factor of 2.5.

Initial metallurgical testing of Loma de La Plata proved highly successful especially as recovery of silver exceeded 80% and the concentrate was high in silver (around 50 kg/t Ag), but low in lead with a combined base metal (copper plus lead) content of 15% to 25%. Subsequent efforts were directed at testing the variability of the deposit in support of a Preliminary Economic Assessment of Loma de La Plata only. The test work at both G&T and XPS concluded that Loma de La Plata ore responds well to flotation, with high recoveries and concentrate grades. A simple crushing, grinding, and single product flotation concentrator was proposed for the PEA, and the concentrate sold to an offshore copper smelter with minor penalties for lead.

With the discovery of Valle Esperanza and its similarity in mineralisation style to Loma de La Plata, metallurgical testing was expanded to incorporate deposits likely to produce a high-value silver concentrate with low lead content. Testing of Valle Esperanza and Barite Hill samples yielded satisfactory results, and as with Loma de La Plata, silver recoveries of 80% or better appear likely. The concentrate grades from Valle Esperanza are particularly high (over 50 kg/t Ag to 60 kg/t Ag), while those from Barite Hill are also satisfactory containing 20 kg/t Ag to 25 kg/t Ag. However, the individual concentrates contain high levels of penalty elements such as arsenic and antimony. Mr. Wells believes that Loma de La Plata, Barite Hill, and Valle Esperanza can all be treated in the same, simple, one-product concentrator.

The testing of Loma de La Plata is likely to be sufficient to support a Feasibility Study. A large quantity of core has been kept in sealed bags and is sufficient for a pilot plant test should this be considered necessary.

The Preliminary Economic Assessment of Loma de La Plata (Snowden, 2008), concluded the development of Loma de La Plata would deliver a pre-tax NPV at 7.5% of US$135.6 million, and internal rate of return (IRR) of 22%, and a 25 month payback period.

The June 2009 Technical Report (Snowden, 2009) disclosed recently updated Mineral Resources at the Calcite NW, Calcite Hill, Navidad Hill, Connector Zone, Galena Hill, Barite Hill, and Loma de La Plata deposits and disclosed the first Mineral Resource for Valle Esperanza at the Navidad Project.

Mineral Resource estimates were reported at the Navidad Property (Table 0.16). Tonnes and grades have been reported above a cut-off of 50 g/t silver equivalent. To date, no analysis has been made to determine the economic cut-off grade that will ultimately be applied to the Navidad Project. Silver equivalence was calculated using three year rolling average prices for silver ($12.52 per oz) and an approximate ten year rolling average price for lead ($0.50 per lb) values. The following formula, which does not include any other factors such as variable metal recoveries, was applied to reach the silver equivalent value: AgEQ (g/t) = Ag (g/t) + (Pb (%) × 10,000/365).

Measured and Indicated Mineral Resources silver ounces have increased by 40% since the November 2007 Mineral Resource estimate. This increase is mainly contributed by the upgrade of Inferred resources to Indicated resources, defined during infill drilling at Loma de La Plata. Valle Esperanza is now estimated to contain the largest Inferred resource of the Project. With additional infill drilling on 50 m sections at Valle Esperanza, the conversion rate of Inferred resources to Indicated resources is anticipated to be as high as that experienced at the other deposits at the Project.

20 Recommendations

Information in this section has been sourced from Snowden (2009).

The following recommendations are made for the further advancement of the Project:

— Continue metallurgical definition of the deposits with particular emphasis on Galena Hill, which hosts 30% of the Indicated Resource silver ounces as well as 2,158 Mlb of lead in the Measured and Indicated categories.

— Using the Loma de La Plata Preliminary Economic Assessment study as a model, develop an expanded model to include Valle Esperanza and Barite Hill as sources of high-grade silver concentrates with relatively low base metal content.

— Develop a global Preliminary Economic Assessment that takes all deposits into consideration with emphasis on an optimum extended mine life.

— Continue selective exploration of the best targets in the core project area that have Loma de La Plata or Valle Esperanza type potential. The continued exploration in the extended Valle Esperanza Valley is one of the highest priority areas.

— Continue to evaluate and prioritise the various mining concessions that Pan American controls along the Gastre Fault structural trend.

— Continue to advance the Navidad environmental base line studies in anticipation of an eventual filing of the appropriate environmental impact statement (EIS). In the short term Pan American plans to engage an international-level consultant to conduct a baseline review and plan the outstanding baseline work to complete the environmental impact assessment (EIA) for the proposed mine. This consultant would conduct an independent evaluation and consult with the Chubut Provincial authorities. The consultant would then assist with baseline studies and ultimately be responsible for preparation of the mine EIA.

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Pan American should increase its efforts to explain and present the Navidad Project to the authorities in the Chubut Provincial government, especially stressing the benefits in employment, infrastructure, and tax revenue that would accrue to the community if the authorities were to rescind legislation that currently prohibits open pit mining.

Pan American should continue to implement proposed continuous improvement practices on diamond drilling, QAQC, sampling, density determinations, and resource modelling aspects at the Project, including:

— Survey all drillholes regardless of their orientation, with the first measurement taken at the collar of the drillhole, to ensure that the spatial location of mineralisation is well defined.

— Continue to refine the effectiveness of the QAQC database through more accurate documentation of the QAQC sample type and the analytical method, and by following the recommendations made by Smee (2008). Pan American is in the process of implementing these recommendations.

— Determine the density of drill core prior to splitting with a diamond saw to reduce the error in the calculation introduced by a small sample size. Samples should be coated with a material such as wax or varnish to prevent water retention in the sample from influencing the calculated specific gravity value. Samples should be selected according to a representative suite of lithologies, mineralisation, and alteration types, through spatially representative locations throughout the area covered by drilling. The representativity can be confirmed by consulting the number of density determinations tabulated by grade estimation domain for each deposit in Table 0.10, and increasing the number of density samples in domains with low sample numbers relative to the number of sample assays in the domain. Spatial representativity can be confirmed by plotting the location of specific gravity samples on the drillhole trace in plan and in section.

— Further refine the geological interpretation to incorporate all available geological information, including surface mapping (including the position of outcropping mineralisation), geophysical information, structural information, and core logging detail in digital, three dimensional format.

— Continue the modelling of fault interpretations for use in future resource estimations.

— Undertake a study of the differences between the oxide and sulphide zones for modelling in future resource estimations.

Snowden further recommends that Pan American undertake a drillhole spacing study at Loma de La Plata using conditional simulation to quantify the optimal drillhole spacing required to achieve a range of estimation qualities. Some close-spaced drilling should be performed in a representative mineralised domain to characterise the short-range behaviour of the mineralisation. Aquiline has already drilled 23 holes at Loma de La Plata in anticipation of such a drillhole spacing study. The outcome of this approach would be an understanding of the degree of grade estimation error associated with particular volumes of mineralisation for a range of drillhole spacing patterns. The grade estimation error and other important aspects of the project data, described in Section 17.10, are considered while assigning Mineral Resource confidence categories.

Pan American plans to proceed to an expanded Preliminary Economic Assessment of the Navidad Project, using the Loma de La Plata PEA study published in October 2008 as a basis (Snowden, 2008), focussing on deposits that are likely to produce a high-value silver concentrate with low lead content and maximise the operational mine life. The study will utilise the updated resource models produced as part of this report, in addition to the metallurgical testing of Valle Esperanza and Barite Hill. A more detailed evaluation of the market for silver/copper concentrates is also required. In addition to examining open pit mining methods, those deposits with likely high strip ratio cutbacks such as Valle Esperanza, Loma de La Plata, and Barite Hill will be evaluated for extraction by underground methods.

More test work with fresh core samples is essential to take Barite Hill and Valle Esperanza to Feasibility Study level to enable Bond Mill work indices to be determined, further tailings settling tests and potential penalty elements including arsenic and antimony.

Further studies of Galena Hill will focus on developing a programme to test the metallurgical variability of the deposit including initial modelling of the geo-metallurgical domains and designing the drill programme for fresh samples. The design of the metallurgical test programme should incorporate opportunities for improving concentrate quality already identified.

Continued exploration in the company's land package in the Navidad district will be directed towards additional Jurassic-age basins in the Gastre structural corridor with Cañadón Asfalto lithologies. Geochemical sampling techniques should be effective tools to efficiently explore these basins. The distribution of associated potassic-style alteration such as adularia within the regional basins may be detected through the interpretation of the 2008 airborne radiometric survey.

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22 Date and signatures

Technical Report

Pan American Silver Corp.: Navidad Project, Chubut Province, Argentina

February 2010

Issued by:

Pan American Silver Corp.

Pamela De Mark [signed]	04 February 2010 Date
John J. Chulick [signed]	04 February 2010 Date
Dean K. Williams [signed]	04 February 2010 Date
John A. Wells [signed]	04 February 2010 Date
Damian Spring [signed]	04 February 2010

23 Certificates

CERTIFICATE of QUALIFIED PERSON

(a) I, Pamela L. De Mark, Senior Consultant of Snowden Mining Industry Consultants Inc., 600-1090 W. Pender St, Vancouver, BC, V6E 2N7 Canada; do hereby certify that:

(b) I am the co-author of the technical report titled "Pan American Silver Corp.: Navidad Project, Chubut Province, Argentina", dated 4 February 2010 (the "Technical Report").

(c) I graduated with a Bachelor of Applied Science (Honours) Degree in Applied Geology from the University of Technology, Sydney (Australia) in 1994. I am a Member of the Australasian Institute of Mining and Metallurgy and am a member of The Association of Professional Engineers and Geoscientists of the Province of British Columbia (License #33050). I have worked as a mining and Mineral Resource geologist for a total of 15 years since my graduation from university.

(d) 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 fulfil the requirements of a 'qualified person' for the purposes of the Instrument. I have been involved in mining and Resource evaluation consulting practice for 3 years. During my working career I have been involved in mining and resource evaluation.

(e) I am responsible for the preparation of the sections of the Technical Report as detailed in Table 2.1.

(f) I am independent of the issuer as defined in section 1.4 of the Instrument.

(g) I have had prior involvement with the Property that is the subject of the Technical Report; I was the co-author of the technical report titled "Aquiline Resources Inc.: Navidad Project, Chubut Province, Argentina" and dated November 2007 and co-author of the amended technical report titled "Aquiline Resources Inc.: Navidad Project, Chubut Province, Argentina" and dated May 2009 and amended June 2009. I also conducted two site visits: (i) from September 10 to September 13, 2007; and (ii) from April 28 to April 30, 2009.

(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, British Columbia, this 4th day of February, 2010.

[signed]

Pamela L. De Mark, P. Geo., BSc(App Geo), MAusIMM

Pan American Silver Corp:

CERTIFICATE of QUALIFIED PERSON

(a) I, John J. Chulick, Licensed Professional Geologist #3945 State of California, of Puerto Varas, Chile; do hereby certify that:

(b) I am a co-author of the technical report titled "Pan American Silver Corp.: Navidad Project, Chubut Province, Argentina" and dated 4 February 2010 (the "Technical Report") under the supervision of Snowden Mining Industry Consultants Inc.

(c) I graduated with the Geological Engineer (Honours) Degree from the Colorado School of Mines, Golden, Colorado, in 1968, and with the degree Masters Business Administration in Finance, 1987, from golden Gate University, San Francisco. I am a Member of the Society of Economic Geologists since 1998 and am a Licensed Professional Geologist (Certificate #3945) in the State of California. I have worked as an Exploration and Economic Geologist for a total of 36 years since my graduation from university.

(d) 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 fulfil the requirements of a 'qualified person' for the purposes of the Instrument.

(e) I am responsible for the preparation of the sections of the Technical Report as detailed in Table 2.1.

(f) I am independent of the issuer as defined in section 1.4 of the Instrument.

(g) I have had prior involvement with the Property that is the subject of the Technical Report; I was the co-author of the amended technical report titled "Aquiline Resources Inc.: Navidad Project, Chubut Province, Argentina" and dated May 2009 and amended June 2009.

(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 scientific and technical information that is required to be disclosed to make the Technical report not misleading.

Dated at Puerto Varas, this 4th day of February, 2010.

[signed]

John J. Chulick

Licensed Professional Geologist #3945 State of California

Pan American Silver Corp:

CERTIFICATE of QUALIFIED PERSON

(j) I, Dean K. Williams, B.Sc., LPG, MBA, of Montevideo, Uruguay; do hereby certify that:

(k) I am a co-author of the technical report titled "Pan American Silver Corp.: Navidad Project, Chubut Province, Argentina" and dated 4 February 2010 (the "Technical Report").

(l) I graduated with a Bachelor of Science (Honours) Degree in Geology from Oregon State University (1979) and a Master of Business Administration from the University of Oregon (Beta Gamma Sigma) in 1988.

I am a Licensed Professional Geologist as recognised by the National Association of State Boards of Geology (ASBOG), as a Licensed Professional Geologist in the State of Utah No. 5338683, and a Fellow of the Society of Economic Geologists since 1993. I have worked as an exploration geologist for a total of 26 years since my graduation from university.

(m) 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 fulfil the requirements of a 'qualified person' for the purposes of the Instrument.

(n) I am responsible for the preparation of the sections of the Technical Report as detailed in Table 2.1.

(o) I am independent of the issuer as defined in section 1.4 of the Instrument.

(p) I have had prior involvement with the Property that is the subject of the Technical Report; I was the co-author of the amended technical report titled "Aquiline Resources Inc.: Navidad Project, Chubut Province, Argentina" and dated May 2009 and amended June 2009.

(q) I have read the Instrument and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.

(r) As of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical report not misleading.

Dated at Montevideo, Uruguay, this 4th day of February, 2010.

[signed]

Dean K. Williams, B.Sc., LPG, MBA

Pan American Silver Corp:

CERTIFICATE of QUALIFIED PERSON

(a) I, Damian Spring, B.E. (Mining), MAusIMM, of Puerto Madryn, Argentina; do hereby certify that:

(b) I am a co-author of the technical report titled "Pan American Silver Corp.: Navidad Project, Chubut Province, Argentina" and dated 4 February 2010 (the "Technical Report").

(c) I graduated with a Bachelor of Engineering (Mining) Degree from the University of Auckland in 1993.

I am a Member of the Australian Institute of Mining and Metallurgy. I have worked as a mining engineer for a total of 15 years since my graduation from university.

(d) 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 fulfil the requirements of a 'qualified person' for the purposes of the Instrument.

(e) I am responsible for the preparation of the sections of the Technical Report as detailed in Table 2.1.

(f) I am independent of the issuer as defined in section 1.4 of the Instrument.

(g) I have had prior involvement with the Property that is the subject of the Technical Report; I was the co-author of the amended technical report titled "Aquiline Resources Inc.: Navidad Project, Chubut Province, Argentina" and dated May 2009 and amended June 2009.

(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 scientific and technical information that is required to be disclosed to make the Technical report not misleading.

Dated at Puerto Madryn, Argentina, this 4th day of February, 2010.

[signed]

Damian Spring, B. E. (Mining), MAusIMM

Pan American Silver Corp:

CERTIFICATE OF QUALIFIED PERSON

(a) I, John A. Wells, Metallurgical Consultant of Vernon, British Columbia, do hereby certify that:

(b) I am a co-author of the technical report titled "Pan American Silver Corp.: Navidad Project, Chubut Province, Argentina" and dated 4 February 2010 (the "Technical Report").

(c) I graduated with the degree of Bachelor of Engineering, Mineral Technology, Honours from the Royal School of Mines, London, England in 1967. I am a Fellow of the South African Institute of Mining and Metallurgy. I have worked as a metallurgical engineer in operational, managerial, technical and consulting roles for 40 years since my graduation from university.

(d) 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 fulfil the requirements of a 'qualified person' for the purposes of the Instrument.

(e) I am responsible for the preparation of the sections of the Technical Report as detailed in Table 2.1 of such report.

(f) I am independent of the issuer as defined in section 1.4 of the Instrument.

(g) I have had prior involvement with the Property that is the subject of the Technical Report; I was the co-author of the amended technical report titled "Aquiline Resources Inc.: Navidad Project, Chubut Province, Argentina" and dated May 2009 and amended June 2009.

(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 scientific and technical Information that is required to be disclosed to make the Technical report not misleading.

Dated at Vernon, British Columbia, this 4th day of February, 2010

[signed]

John A. Wells
B.Sc (Hons), MBA, MCIMM, FSAIMM

A Collar locations of drillholes available in the Navidad 2009 Mineral Resource estimates

Pan American Silver Corp:

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Barite Hill	NV04-058	2516311.400	5303248.930	1156.790	173.1	Existing
Barite Hill	NV04-059	2516267.780	5303169.230	1141.820	191.1	Existing
Barite Hill	NV04-060	2516209.480	5303266.940	1144.830	131.1	Existing
Barite Hill	NV04-074	2516391.130	5303188.640	1165.290	158	Existing
Barite Hill	NV04-075	2516556.680	5303073.050	1162.850	158	Existing
Barite Hill	NV04-076	2516734.980	5302976.190	1170.550	152	Existing
Barite Hill	NV04-091	2516673.380	5302980.430	1164.970	187.5	Existing
Barite Hill	NV04-092	2516831.530	5302677.100	1141.970	163.9	Existing
Barite Hill	NV07-395	2516735.260	5302975.410	1170.720	183.5	Existing
Barite Hill	NV07-396	2516685.890	5302893.590	1151.390	234.8	Existing
Barite Hill	NV07-397	2516635.220	5302804.160	1146.930	238	Existing
Barite Hill	NV07-398	2516828.690	5302933.620	1168.100	204.1	Existing
Barite Hill	NV07-399	2516827.720	5302931.970	1168.060	202	Existing
Barite Hill	NV07-400	2516823.120	5302730.340	1150.950	235.3	Existing
Barite Hill	NV07-401	2517028.600	5302683.110	1130.160	211.2	Existing
Barite Hill	NV07-402	2516875.550	5302422.840	1116.830	277.3	Existing
Barite Hill	NV07-403	2516579.830	5302703.860	1123.840	214.3	Existing
Barite Hill	NV07-441	2516520.180	5302598.740	1122.990	40	Existing
Barite Hill	NV07-442	2516519.430	5302597.440	1123.000	297	Existing
Barite Hill	NV07-443	2516477.440	5302731.230	1122.840	237.5	Existing
Barite Hill	NV07-444	2516590.900	5302623.200	1121.280	253	Existing
Barite Hill	NV07-445	2516540.530	5302836.200	1136.940	229	Existing
Barite Hill	NV07-446	2516584.120	5302915.420	1147.900	220	Existing
Barite Hill	NV07-447	2516707.240	5302821.830	1141.820	238	Existing
Barite Hill	NV07-448	2516649.890	5302724.650	1131.390	226.5	Existing
Barite Hill	NV07-449	2516612.750	5302561.390	1121.040	232	Existing
Barite Hill	NV07-450	2516667.520	5302656.700	1123.120	232	Existing
Barite Hill	NV07-451	2516508.410	5302676.700	1123.430	229	Existing
Barite Hill	NV07-452	2516561.840	5302764.450	1130.220	157	Existing
Barite Hill	NV07-457	2516550.390	5302650.530	1122.150	240.2	Existing

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Barite Hill	NV07-458	2516567.730	5302582.120	1122.090	240.2	Existing
Barite Hill	NV07-459	2516621.820	5302678.920	1123.040	238	Existing
Barite Hill	NV07-460	2516634.570	5302601.880	1120.640	259	Existing
Barite Hill	NV07-461	2516490.170	5302557.230	1123.900	292	Existing
Barite Hill	NV07-462	2516583.600	5302514.580	1123.060	256	Existing
Barite Hill	NV07-463	2516667.490	5302563.420	1119.900	256	Existing
Barite Hill	NV07-464	2516641.200	5302513.710	1120.110	289	Existing
Barite Hill	NV07-465	2516695.890	5302613.300	1121.750	247	Existing
Barite Hill	NV07-466	2516722.730	5302659.170	1125.490	247	Existing
Barite Hill	NV07-467	2516730.460	5302562.170	1119.780	268	Existing
Barite Hill	NV07-468	2516750.300	5302605.460	1125.030	262	Existing
Barite Hill	NV07-469	2516696.980	5302509.780	1119.090	277	Existing
Barite Hill	NV07-470	2516693.150	5302701.280	1127.890	253	Existing
Barite Hill	NV07-471	2516635.210	5302804.190	1146.800	217	Existing
Barite Hill	NV07-472	2516673.470	5302772.610	1140.030	223	Existing
Barite Hill	NV07-473	2516720.460	5302748.950	1133.580	235	Existing
Barite Hill	NV07-474	2516322.050	5302860.910	1124.450	274	Existing
Barite Hill	NV07-475	2516374.750	5302956.610	1131.180	229	Existing
Barite Hill	NV07-476	2516430.560	5303048.590	1144.230	232	Existing
Barite Hill	NV07-477	2516473.300	5303125.640	1164.600	201.5	Existing
Barite Hill	NV07-478	2516164.540	5302985.900	1125.600	259.2	Existing
Barite Hill	NV07-603	2516641.540	5302413.780	1122.730	388.6	New
Barite Hill	NV07-606	2516479.110	5302637.110	1123.570	273.4	New
Barite Hill	NV07-608	2516496.310	5302866.550	1132.910	222	New
Barite Hill	NV07-610	2516733.220	5302875.520	1151.500	240	New
Barite Hill	NV08-698	2516113.620	5302899.120	1125.180	307	New
Calcite Hill	NV04-088	2514048.420	5304731.070	1223.640	192.3	Existing
Calcite Hill	NV04-121	2514191.120	5304568.760	1202.760	149.1	Existing
Calcite Hill	NV04-122	2514148.420	5304649.380	1210.560	253.45	Existing
Calcite Hill	NV04-123	2514144.630	5304642.940	1210.280	199.88	Existing
Calcite Hill	NV04-124	2514075.000	5304772.820	1227.400	209.27	Existing
Calcite Hill	NV04-125	2514022.520	5304685.500	1219.740	167.1	Existing
Calcite Hill	NV04-126	2514059.790	5304648.470	1214.600	283.5	Existing
Calcite Hill	NV05-134	2514129.910	5304759.720	1222.360	281	Existing

Pan American Silver Corp:

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Calcite Hill	NV05-135	2514160.100	5304818.020	1223.940	266	Existing
Calcite Hill	NV05-136	2514210.370	5304912.550	1227.580	251	Existing
Calcite Hill	NV05-137	2514101.660	5304817.410	1229.040	262	Existing
Calcite Hill	NV05-138	2514157.890	5304814.350	1223.910	250	Existing
Calcite Hill	NV05-143	2514236.870	5304809.940	1216.840	268.8	Existing
Calcite Hill	NV05-144	2514274.730	5304712.210	1210.030	260.1	Existing
Calcite Hill	NV05-145	2514249.310	5304669.110	1208.110	250.7	Existing
Calcite Hill	NV05-146	2514301.250	5304563.610	1198.680	199.8	Existing
Calcite Hill	NV05-147	2514285.140	5304539.560	1194.180	191.1	Existing
Calcite Hill	NV05-148	2514015.770	5304767.970	1229.460	170.1	Existing
Calcite Hill	NV05-149	2514038.450	5304811.510	1233.670	221.1	Existing
Calcite Hill	NV05-150	2513959.620	5304767.660	1230.020	188.1	Existing
Calcite Hill	NV05-151	2513984.280	5304811.650	1233.570	176.1	Existing
Calcite Hill	NV05-152	2514009.510	5304856.380	1238.990	221.1	Existing
Calcite Hill	NV05-162	2514269.230	5304787.710	1214.370	274.8	Existing
Calcite Hill	NV05-163	2514258.590	5304582.720	1196.650	215.1	Existing
Calcite Hill	NV05-164	2514334.970	5304523.970	1193.810	195.6	Existing
Calcite Hill	NV05-165	2514361.200	5304570.920	1201.730	170.1	Existing
Calcite Hill	NV05-166	2514344.520	5304631.900	1206.500	146.1	Existing
Calcite Hill	NV05-167	2514009.730	5304857.460	1239.010	158.1	Existing
Calcite Hill	NV05-168	2514040.920	5304911.010	1235.750	167.1	Existing
Calcite Hill	NV05-169	2513936.160	5304833.120	1234.420	129	Existing
Calcite Hill	NV05-170	2513963.870	5304875.930	1237.230	143.4	Existing
Calcite Hill	NV05-171	2513985.090	5304909.070	1237.940	134.1	Existing
Calcite Hill	NV05-172	2514159.030	5304674.170	1211.880	281.1	Existing
Calcite Hill	NV05-173	2514183.790	5304788.090	1221.240	248.4	Existing
Calcite Hill	NV05-174	2514244.660	5304741.740	1214.010	263.1	Existing
Calcite Hill	NV05-176	2513985.080	5304909.110	1238.000	233.1	Existing
Calcite Hill	NV05-177	2514034.470	5304901.210	1236.130	239.1	Existing
Calcite Hill	NV05-180	2513902.830	5304876.270	1233.840	131.4	Existing
Calcite Hill	NV05-181	2513928.760	5304924.450	1237.230	161.2	Existing
Calcite Hill	NV05-182	2513952.000	5304968.020	1239.630	218.2	Existing
Calcite Hill	NV05-183	2514064.230	5304854.050	1234.440	257.2	Existing
Calcite Hill	NV05-184	2514108.500	5304732.490	1220.530	209.2	Existing

Pan American Silver Corp:

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Calcite Hill	NV05-185	2514314.090	5304685.050	1209.530	164	Existing
Calcite Hill	NV05-186	2514367.520	5304678.240	1210.550	119	Existing
Calcite Hill	NV05-187	2514060.410	5304646.210	1214.370	185	Existing
Calcite Hill	NV05-188	2514269.170	5304787.590	1214.250	236	Existing
Calcite Hill	NV05-205	2514333.440	5304721.200	1210.700	163.5	Existing
Calcite Hill	NV05-206	2514351.590	5304748.160	1207.220	190	Existing
Calcite Hill	NV05-207	2514389.920	5304719.810	1208.790	166	Existing
Calcite Hill	NV05-208	2514396.720	5304618.630	1205.310	125	Existing
Calcite Hill	NV05-209	2514289.330	5304737.650	1211.560	227	Existing
Calcite Hill	NV05-210	2514426.910	5304677.820	1210.240	209	Existing
Calcite Hill	NV05-211	2514160.420	5304748.420	1219.290	233	Existing
Calcite Hill	NV05-212	2514140.510	5304711.940	1216.800	212	Existing
Calcite Hill	NV05-239	2514442.580	5304707.270	1209.480	103	Existing
Calcite Hill	NV05-240	2514434.760	5304691.690	1210.430	90	Existing
Calcite Hill	NV05-246	2514286.750	5304732.030	1211.130	209.5	Existing
Calcite Hill	NV05-247	2514291.670	5304742.050	1211.910	173.4	Existing
Calcite Hill	NV06-270	2514436.090	5304792.770	1189.950	68	Existing
Calcite Hill	NV06-271	2514403.860	5304799.550	1190.000	101.2	Existing
Calcite Hill	NV06-316	2514133.980	5304825.150	1226.770	233	Existing
Calcite Hill	NV06-317	2514121.590	5304803.300	1226.560	215	Existing
Calcite Hill	NV06-318	2514109.640	5304781.420	1226.960	206	Existing
Calcite Hill	NV06-324	2514096.980	5304758.750	1224.330	200	Existing
Calcite Hill	NV06-325	2514082.590	5304734.210	1223.210	178	Existing
Calcite Hill	NV06-326	2514085.060	5304864.540	1232.870	218	Existing
Calcite Hill	NV06-327	2514072.760	5304841.370	1233.130	194	Existing
Calcite Hill	NV06-328	2514059.450	5304819.050	1232.800	179	Existing
Calcite Hill	NV06-329	2514046.730	5304795.290	1231.560	166.5	Existing
Calcite Hill	NV06-330	2514033.310	5304773.450	1229.180	152	Existing
Calcite Hill	NV06-331	2514020.950	5304751.340	1227.840	146	Existing
Calcite Hill	NV07-482	2514462.700	5304888.910	1178.540	189.4	Existing
Calcite Hill	NV07-483	2514456.720	5305066.780	1167.330	48.4	Existing
Calcite Hill	NV07-484	2514394.060	5305034.240	1182.130	57.6	Existing
Calcite Hill	NV07-485	2514347.140	5305058.300	1179.900	66.1	Existing
Calcite Hill	NV07-612	2514370.960	5304982.830	1194.700	131	New

Pan American Silver Corp:

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Calcite Hill	NV07-613	2514321.270	5305014.270	1190.480	120.6	New
Calcite Hill	NV07-614	2514329.510	5305113.110	1178.680	79.8	New
Calcite Hill	NV07-615	2514308.540	5305065.350	1182.090	121.3	New
Calcite Hill	NV07-617	2514450.860	5305018.780	1180.020	91.5	New
Calcite Hill	NV07-618	2514417.680	5304959.260	1194.560	117.8	New
Calcite NW	NV05-178	2513464.660	5305117.510	1222.640	302	Existing
Calcite NW	NV05-179	2513419.980	5305032.070	1207.990	212.1	Existing
Calcite NW	NV05-189	2513458.150	5305302.250	1181.490	211.5	Existing
Calcite NW	NV05-190	2513497.490	5305375.350	1174.780	158	Existing
Calcite NW	NV05-191	2512985.560	5305686.600	1167.190	197	Existing
Calcite NW	NV05-192	2512944.290	5305608.880	1167.880	209	Existing
Calcite NW	NV05-198	2513829.120	5305018.130	1238.470	221.3	Existing
Calcite NW	NV05-199	2513834.280	5305027.500	1238.410	170.1	Existing
Calcite NW	NV05-200	2513548.840	5305059.450	1221.380	275.1	Existing
Calcite NW	NV05-201	2513549.250	5305060.340	1221.420	200	Existing
Calcite NW	NV05-202	2513502.260	5304969.080	1214.530	149.1	Existing
Calcite NW	NV05-203	2513359.650	5305149.100	1210.660	324.75	Existing
Calcite NW	NV05-204	2513360.110	5305150.080	1210.590	161	Existing
Calcite NW	NV05-213	2513913.970	5304983.940	1238.440	263	Existing
Calcite NW	NV05-214	2513135.040	5305543.430	1172.770	254	Existing
Calcite NW	NV05-215	2513283.970	5305398.620	1176.240	254	Existing
Calcite NW	NV05-216	2513117.800	5305113.600	1197.770	200	Existing
Calcite NW	NV05-222	2513272.250	5305178.100	1199.130	239	Existing
Calcite NW	NV05-223	2513272.680	5305178.990	1199.200	181.5	Existing
Calcite NW	NV05-224	2513471.940	5304924.770	1220.350	152	Existing
Calcite NW	NV05-225	2513395.550	5304994.280	1212.450	146	Existing
Calcite NW	NV05-226	2513334.500	5305087.970	1201.780	140	Existing
Calcite NW	NV05-227	2513581.090	5304909.780	1220.070	251	Existing
Calcite NW	NV06-255	2513634.350	5304802.630	1222.710	131	Existing
Calcite NW	NV06-256	2513714.130	5304749.280	1220.660	185	Existing
Calcite NW	NV06-257	2513801.020	5304602.590	1206.830	140	Existing
Calcite NW	NV06-258	2513689.900	5304704.300	1218.000	100.8	Existing
Calcite NW	NV06-259	2513739.970	5304791.400	1223.840	122	Existing
Calcite NW	NV06-260	2513658.350	5304847.600	1226.470	131	Existing

Pan American Silver Corp:

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Calcite NW	NV06-261	2513553.240	5304865.980	1220.750	131.5	Existing
Calcite NW	NV06-262	2513468.430	5305020.010	1211.140	122	Existing
Calcite NW	NV06-263	2513493.450	5305058.950	1219.290	131	Existing
Calcite NW	NV06-264	2513417.810	5305129.340	1218.530	134	Existing
Calcite NW	NV06-265	2513327.000	5305172.950	1205.650	137.1	Existing
Calcite NW	NV06-267	2513311.450	5305350.690	1178.660	149.2	Existing
Calcite NW	NV06-268	2513298.270	5305324.740	1180.870	143.4	Existing
Calcite NW	NV06-269	2513184.660	5305428.570	1178.130	161	Existing
Calcite NW	NV06-308	2513460.580	5305110.260	1222.240	134	Existing
Calcite NW	NV06-309	2513420.770	5305134.250	1218.370	139.5	Existing
Calcite NW	NV06-310	2513420.350	5305133.430	1218.440	140	Existing
Calcite NW	NV06-311	2513327.160	5305173.910	1205.600	160.5	Existing
Calcite NW	NV06-312	2513226.350	5305201.890	1197.460	101	Existing
Calcite NW	NV06-313	2513379.100	5305064.650	1205.250	110	Existing
Calcite NW	NV06-314	2513442.180	5304973.320	1216.180	122	Existing
Calcite NW	NV06-315	2513522.780	5305214.220	1196.320	91	Existing
Calcite NW	NV07-411	2513209.640	5304864.680	1211.760	349	New
Calcite NW	NV07-412	2512565.850	5305752.780	1165.120	301.2	Existing
Calcite NW	NV07-413	2513210.890	5305473.890	1176.030	109.3	Existing
Calcite NW	NV07-414	2513163.480	5305392.120	1180.290	106.3	Existing
Calcite NW	NV07-415	2513308.290	5305445.210	1174.430	151.2	Existing
Calcite NW	NV07-416	2513263.750	5305364.790	1178.610	151	Existing
Calcite NW	NV07-417	2513335.680	5305396.070	1175.150	121.2	Existing
Calcite NW	NV07-418	2513352.260	5305314.930	1181.470	121	Existing
Calcite NW	NV07-419	2513485.910	5305249.410	1189.900	91.2	Existing
Calcite NW	NV07-420	2513358.610	5305030.340	1206.310	94	Existing
Calcite NW	NV07-421	2513390.740	5304987.180	1213.380	91	Existing
Calcite NW	NV07-422	2513420.750	5304931.490	1216.680	100	Existing
Calcite NW	NV07-423	2513505.230	5304905.880	1218.600	115	Existing
Calcite NW	NV07-424	2513536.070	5304931.240	1216.920	118.2	Existing
Calcite NW	NV07-425	2513557.810	5304977.470	1219.650	112	Existing
Calcite NW	NV07-426	2513592.430	5305021.170	1224.520	121	Existing
Calcite NW	NV07-427	2513593.520	5305023.030	1224.480	123.6	Existing
Calcite NW	NV07-428	2513614.820	5304999.760	1226.500	121	Existing

Pan American Silver Corp:

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Calcite NW	NV07-429	2513616.060	5305001.720	1226.540	132.6	Existing
Calcite NW	NV07-430	2513592.430	5304952.220	1221.700	127	Existing
Calcite NW	NV07-514	2512714.900	5305612.360	1166.340	145.1	Existing
Calcite NW	NV07-516	2512767.460	5305696.020	1163.140	146.1	Existing
Calcite NW	NV07-518	2512813.600	5305788.290	1160.630	107.1	Existing
Calcite NW	NV07-520	2512519.390	5305670.690	1170.830	131.1	Existing
Calcite NW	NV07-521	2512541.360	5305709.470	1167.550	113.1	Existing
Calcite NW	NV07-523	2512616.000	5305840.470	1162.920	104.1	Existing
Calcite NW	NV07-524	2512639.090	5305886.510	1164.150	113.1	Existing
Calcite NW	NV07-525	2513010.340	5305729.760	1167.640	82.8	Existing
Calcite NW	NV07-527	2512911.010	5305556.710	1167.340	128.1	Existing
Calcite NW	NV07-528	2513160.690	5305588.280	1171.310	149	Existing
Calcite NW	NV07-530	2513113.850	5305503.670	1177.780	152.1	Existing
Calcite NW	NV07-531	2513089.960	5305464.910	1177.450	113.1	Existing
Calcite NW	NV07-533	2513187.220	5305634.330	1172.930	128	Existing
Calcite NW	NV07-534	2513137.780	5305351.930	1181.300	101.1	Existing
Calcite NW	NV07-536	2513236.980	5305514.750	1176.270	116.1	Existing
Calcite NW	NV07-538	2513264.260	5305560.250	1173.540	101.1	Existing
Calcite NW	NV07-539	2512838.830	5305828.870	1160.110	107.1	Existing
Calcite NW	NV07-541	2513000.300	5305504.610	1172.480	107.1	Existing
Calcite NW	NV07-542	2512527.410	5305892.240	1164.640	89.1	Existing
Calcite NW	NV07-544	2512479.690	5305805.580	1165.260	110.1	Existing
Calcite NW	NV07-545	2512667.090	5305926.680	1165.070	83.1	Existing
Calcite NW	NV07-565	2513861.620	5304901.130	1233.140	158.1	Existing
Calcite NW	NV07-567	2513871.560	5305001.500	1238.020	154.4	Existing
Calcite NW	NV07-568	2513821.840	5304932.130	1232.180	161.1	Existing
Calcite NW	NV07-570	2513769.400	5304938.130	1231.250	158.1	Existing
Calcite NW	NV07-572	2513792.820	5304982.710	1234.910	146.1	Existing
Calcite NW	NV07-573	2513741.120	5304986.040	1234.910	172.3	Existing
Calcite NW	NV07-574	2513735.610	5304977.720	1234.530	155	Existing
Calcite NW	NV07-576	2513677.860	5304974.830	1233.990	208.3	New
Calcite NW	NV07-577	2513678.810	5304976.160	1234.080	167	New
Calcite NW	NV07-578	2513624.340	5304888.840	1225.950	179.1	New
Calcite NW	NV07-580	2513600.150	5304849.200	1224.200	161	New

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Calcite NW	NV07-582	2512400.190	5305691.150	1175.410	161	New
Calcite NW	NV07-583	2512299.000	5305659.310	1185.560	110.1	New
Calcite NW	NV07-584	2512471.580	5305996.370	1173.430	76.6	New
Calcite NW	NV07-585	2513532.440	5304822.730	1221.730	69.4	New
Calcite NW	NV07-587	2513492.170	5304856.780	1220.270	101.4	New
Calcite NW	NV07-589	2513453.750	5304894.870	1219.950	104.1	New
Calcite NW	NV07-590	2513395.100	5304890.060	1220.900	107	New
Calcite NW	NV07-638	2513691.100	5305102.400	1206.420	223	New
Calcite NW	NV07-639	2513743.100	5305191.900	1206.240	220	New
Calcite NW	NV07-641	2513830.560	5305142.440	1210.520	163	New
Calcite NW	NV07-642	2513950.640	5305155.540	1211.890	160	New
Calcite NW	NV07-645	2513622.460	5305188.580	1190.810	271	New
Calcite NW	NV08-913	2513553.440	5304763.640	1221.860	100.5	New
Calcite NW	NV08-914	2513441.840	5304770.330	1220.530	85.7	New
Calcite NW	NV08-915	2513314.440	5304945.190	1218.860	97.5	New
Calcite NW	NV08-916	2513227.420	5305095.980	1199.300	85.5	New
Connector Zone	NV04-027	2514763.200	5304161.110	1163.980	181.5	Existing
Connector Zone	NV04-032	2515378.850	5304232.780	1154.650	154.5	Existing
Connector Zone	NV04-033	2515342.990	5304169.820	1154.800	149	Existing
Connector Zone	NV04-034	2514950.940	5304325.760	1180.000	228.2	Existing
Connector Zone	NV04-039	2515154.550	5304239.870	1157.090	215	Existing
Connector Zone	NV04-040	2515212.180	5304340.550	1155.900	127.2	Existing
Connector Zone	NV04-066	2514861.460	5304332.580	1183.940	181.5	Existing
Connector Zone	NV04-067	2514998.140	5304275.730	1170.750	226.5	Existing
Connector Zone	NV04-068	2515162.290	5304352.700	1163.740	178.5	Existing
Connector Zone	NV04-086	2515348.390	5304285.920	1148.210	169.5	Existing
Connector Zone	NV04-087	2515406.500	5304174.580	1160.180	159.5	Existing
Connector Zone	NV04-094	2515178.000	5304280.500	1156.860	172.5	Existing
Connector Zone	NV04-095	2514980.170	5304237.840	1166.900	100.5	Existing
Connector Zone	NV04-096	2514818.590	5304260.000	1174.150	100.5	Existing
Connector Zone	NV04-105	2515132.310	5304401.870	1175.990	82.7	Existing
Connector Zone	NV04-106	2515093.720	5304333.380	1170.570	88.7	Existing
Connector Zone	NV04-107	2515289.470	5304323.460	1147.650	118.1	Existing
Connector Zone	NV04-108	2515378.590	5304230.250	1154.550	145.5	Existing

Pan American Silver Corp:

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Connector Zone	NV04-127	2515265.620	5304291.120	1149.550	137.1	Existing
Connector Zone	NV04-128	2515265.540	5304336.390	1149.920	109.6	Existing
Connector Zone	NV04-129	2515309.070	5304307.370	1146.420	28.8	Existing
Connector Zone	NV04-130	2515307.870	5304305.070	1146.460	106.8	Existing
Connector Zone	NV04-131	2515371.800	5304259.800	1152.040	130.8	Existing
Connector Zone	NV05-153	2515447.370	5304354.790	1143.380	163.8	Existing
Connector Zone	NV05-154	2515453.330	5304354.350	1143.210	190.8	Existing
Connector Zone	NV05-155	2515474.090	5304273.250	1149.470	88.8	Existing
Connector Zone	NV05-156	2515379.440	5304305.290	1148.830	110.1	Existing
Connector Zone	NV05-228	2515147.950	5304430.180	1178.550	61.5	Existing
Connector Zone	NV05-229	2515398.630	5304153.110	1159.120	79.5	Existing
Connector Zone	NV05-230	2515242.800	5304392.370	1155.610	82.3	Existing
Connector Zone	NV05-231	2515422.170	5304351.680	1145.020	80	Existing
Connector Zone	NV05-232	2515423.230	5304351.750	1145.020	67.3	Existing
Connector Zone	NV05-233	2515408.470	5304300.930	1150.700	100.3	Existing
Connector Zone	NV05-234	2515422.580	5304250.790	1155.320	70.1	Existing
Connector Zone	NV05-235	2515344.790	5304250.430	1150.550	143	Existing
Connector Zone	NV05-236	2515375.170	5304200.830	1157.210	100.4	Existing
Connector Zone	NV05-237	2515450.570	5304303.480	1149.690	82.2	Existing
Connector Zone	NV06-376	2515149.100	5304330.070	1163.700	145.1	Existing
Connector Zone	NV06-377	2515127.640	5304293.240	1163.040	135.8	Existing
Connector Zone	NV06-378	2515066.500	5304287.990	1167.820	109.5	Existing
Connector Zone	NV06-379	2515036.930	5304335.060	1177.440	69.8	Existing
Connector Zone	NV06-380	2514954.530	5304194.050	1163.750	84.8	Existing
Connector Zone	NV06-381	2514943.540	5304275.030	1172.520	81.9	Existing
Connector Zone	NV06-390	2515037.590	5304237.820	1165.190	106.1	Existing
Connector Zone	NV06-391	2515102.480	5304249.460	1161.840	153.9	Existing
Connector Zone	NV07-556	2514996.150	5304366.230	1186.680	79.7	Existing
Connector Zone	NV07-558	2514920.480	5304230.710	1168.060	172.7	Existing
Connector Zone	NV07-560	2515061.950	5304381.730	1183.780	70.7	Existing
Connector Zone	NV07-561	2515113.750	5304366.930	1173.130	76.7	Existing
Connector Zone	NV07-562	2515189.800	5304400.150	1165.510	112.6	Existing
Connector Zone	NV07-563	2515010.700	5304191.430	1161.630	127.7	Existing
Connector Zone	NV08-673	2515284.410	5304060.370	1151.730	292.3	New

Pan American Silver Corp:

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Connector Zone	NV08-675	2515177.120	5304077.090	1150.110	280.1	New
Connector Zone	NV08-677	2515237.150	5304185.670	1152.040	208	New
Connector Zone	NV08-679	2515231.560	5303973.520	1148.840	313.4	New
Connector Zone	NV08-680	2515295.640	5303887.940	1150.420	295.1	New
Connector Zone	NV08-682	2515349.660	5303979.710	1154.600	274.15	New
Connector Zone	NV08-683	2515401.550	5304065.010	1159.080	226	New
Connector Zone	NV08-717	2515202.590	5304121.570	1151.280	250	New
Connector Zone	NV08-719	2515152.340	5304033.130	1148.790	310	New
Connector Zone	NV08-721	2515121.070	5304076.020	1150.820	304	New
Connector Zone	NV08-723	2515145.650	5304121.300	1152.120	301	New
Connector Zone	NV08-726	2515231.000	5304067.660	1150.250	268	New
Connector Zone	NV08-727	2515208.760	5304022.650	1148.860	298	New
Connector Zone	NV08-867	2515158.900	5303946.640	1146.540	334	New
Connector Zone	NV08-896	2515102.040	5303945.390	1147.030	352.5	New
Connector Zone	NV08-897	2515281.240	5304156.490	1153.050	205	New
Connector Zone	NV08-898	2515330.670	5304243.060	1151.110	142	New
Connector Zone	NV08-899	2515197.870	5304208.030	1153.650	211.5	New
Connector Zone	NV08-900	2515064.340	5304178.850	1158.250	160	New
Connector Zone	NV08-901	2514967.510	5304120.200	1157.520	151.5	New
Connector Zone	NV08-902	2514910.000	5304121.000	1159.000	130.5	New
Connector Zone	NV08-903	2514876.140	5304155.400	1161.860	154	New
Galena Hill	NV03-003	2515651.550	5303580.250	1178.410	178.5	Existing
Galena Hill	NV03-004	2515655.940	5303588.630	1178.560	284.98	Existing
Galena Hill	NV03-005	2515722.190	5303703.340	1176.620	217.7	Existing
Galena Hill	NV04-012	2515610.530	5303508.960	1155.400	220	Existing
Galena Hill	NV04-013	2515583.070	5304029.530	1179.400	142.7	Existing
Galena Hill	NV04-014	2515636.300	5303879.560	1178.050	158	Existing
Galena Hill	NV04-015	2515776.140	5303797.360	1167.040	139.55	Existing
Galena Hill	NV04-016	2515547.640	5303399.230	1138.270	250.5	Existing
Galena Hill	NV04-017	2515488.650	5303621.440	1156.680	164.2	Existing
Galena Hill	NV04-018	2515365.900	5303403.790	1137.100	274.7	Existing
Galena Hill	NV04-019	2515597.250	5303803.360	1181.710	188.1	Existing
Galena Hill	NV04-020	2515459.490	5303965.350	1162.970	70.9	Existing
Galena Hill	NV04-021	2515654.740	5303911.410	1174.210	198.1	Existing

Pan American Silver Corp:

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Galena Hill	NV04-022	2515670.170	5303936.430	1171.940	193.75	Existing
Galena Hill	NV04-023	2515539.960	5303706.400	1177.310	191.1	Existing
Galena Hill	NV04-024	2515524.920	5304072.420	1173.770	145.6	Existing
Galena Hill	NV04-026	2515375.610	5303818.940	1153.530	134	Existing
Galena Hill	NV04-028	2515757.600	5303755.760	1170.640	158	Existing
Galena Hill	NV04-029	2515865.360	5303673.310	1157.590	158	Existing
Galena Hill	NV04-030	2515825.520	5303601.740	1159.770	209	Existing
Galena Hill	NV04-031	2515655.100	5303585.940	1178.490	296	Existing
Galena Hill	NV04-035	2515480.850	5303206.530	1134.200	293	Existing
Galena Hill	NV04-036	2515588.310	5303995.310	1176.540	77	Existing
Galena Hill	NV04-037	2515553.220	5303930.970	1173.840	102.5	Existing
Galena Hill	NV04-038	2515503.350	5303850.010	1164.380	107	Existing
Galena Hill	NV04-041	2515724.240	5303865.370	1174.950	145.2	Existing
Galena Hill	NV04-042	2515721.530	5303861.620	1174.530	187.9	Existing
Galena Hill	NV04-043	2515678.740	5303787.430	1180.330	230.6	Existing
Galena Hill	NV04-044	2515626.320	5303698.870	1188.150	232.9	Existing
Galena Hill	NV04-045	2515813.050	5303719.060	1163.980	167	Existing
Galena Hill	NV04-046	2515763.810	5303630.940	1168.580	239	Existing
Galena Hill	NV04-047	2515728.050	5303560.160	1176.620	242	Existing
Galena Hill	NV04-048	2515934.790	5303787.090	1147.180	67.5	Existing
Galena Hill	NV04-049	2515900.820	5303730.850	1150.500	82.8	Existing
Galena Hill	NV04-050	2515798.470	5303835.790	1165.660	113	Existing
Galena Hill	NV04-051	2515806.250	5303850.900	1165.500	100.5	Existing
Galena Hill	NV04-052	2515566.700	5303962.090	1173.440	100.5	Existing
Galena Hill	NV04-053	2515483.920	5304017.140	1169.230	97.5	Existing
Galena Hill	NV04-056	2515633.610	5303983.940	1178.090	142.5	Existing
Galena Hill	NV04-057	2515690.960	5303733.140	1180.570	245.1	Existing
Galena Hill	NV04-093	2515993.770	5303285.470	1133.570	200	New
Galena Hill	NV05-175	2515629.030	5303700.960	1187.900	516.12	Existing
Galena Hill	NV05-197	2515698.280	5303820.670	1177.360	441.05	Existing
Galena Hill	NV06-272	2515595.260	5303768.100	1180.710	175.7	Existing
Galena Hill	NV06-273	2515582.800	5303747.520	1183.110	185	Existing
Galena Hill	NV06-274	2515571.160	5303725.490	1186.680	197	Existing
Galena Hill	NV06-275	2515608.240	5303792.360	1181.900	161	Existing

Pan American Silver Corp:

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Galena Hill	NV06-276	2515619.820	5303813.350	1184.620	197	Existing
Galena Hill	NV06-277	2515591.020	5303712.780	1187.470	212.2	Existing
Galena Hill	NV06-278	2515603.230	5303733.280	1186.790	212	Existing
Galena Hill	NV06-279	2515615.780	5303755.590	1183.550	206	Existing
Galena Hill	NV06-280	2515628.260	5303776.500	1184.050	218.4	Existing
Galena Hill	NV06-281	2515641.200	5303798.000	1182.990	212	Existing
Galena Hill	NV06-282	2515612.580	5303699.120	1188.080	227.3	Existing
Galena Hill	NV06-283	2515625.230	5303721.680	1186.980	227	Existing
Galena Hill	NV06-284	2515636.720	5303741.630	1184.670	230.2	Existing
Galena Hill	NV06-285	2515649.710	5303762.960	1183.040	224	Existing
Galena Hill	NV06-286	2515662.210	5303784.880	1181.470	206	Existing
Galena Hill	NV06-295	2515607.100	5303763.730	1182.130	206	Existing
Galena Hill	NV06-296	2515665.000	5303813.680	1181.360	215	Existing
Galena Hill	NV06-302	2515643.130	5303825.430	1181.920	224	Existing
Galena Hill	NV06-303	2515631.150	5303804.960	1183.790	200	Existing
Galena Hill	NV06-304	2515618.480	5303784.140	1183.270	199.7	Existing
Galena Hill	NV06-305	2515651.730	5303791.900	1182.260	206	Existing
Galena Hill	NV06-306	2515639.140	5303770.340	1183.740	209	Existing
Galena Hill	NV06-307	2515626.160	5303748.760	1184.390	207.66	Existing
Galena Hill	NV06-366	2515702.680	5303527.390	1170.110	253.6	Existing
Galena Hill	NV06-367	2515820.910	5303735.260	1162.890	127.2	Existing
Galena Hill	NV06-368	2515850.120	5303787.560	1156.390	90.1	Existing
Galena Hill	NV06-369	2515602.170	5303654.840	1180.140	234	Existing
Galena Hill	NV06-370	2515626.510	5303957.190	1175.810	139.3	Existing
Galena Hill	NV06-371	2515599.760	5303910.100	1177.180	150.8	Existing
Galena Hill	NV06-372	2515574.680	5303866.350	1178.180	150.2	Existing
Galena Hill	NV06-373	2515548.600	5303819.010	1170.260	130.1	Existing
Galena Hill	NV06-374	2515482.820	5303805.520	1165.720	109.1	Existing
Galena Hill	NV06-375	2515455.390	5303760.240	1163.990	97	Existing
Galena Hill	NV07-392	2516027.070	5303349.660	1138.710	142	Existing
Galena Hill	NV07-393	2516081.260	5303443.190	1141.750	94.1	Existing
Galena Hill	NV07-394	2516138.070	5303545.720	1136.100	49	Existing
Galena Hill	NV07-548	2515949.200	5303513.180	1150.820	181.7	Existing
Galena Hill	NV07-551	2516000.080	5303606.220	1142.960	85.7	Existing

Pan American Silver Corp:

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Galena Hill	NV07-552	2516048.060	5303688.100	1137.350	61.7	Existing
Galena Hill	NV07-553	2515956.950	5303679.950	1145.320	87.2	Existing
Galena Hill	NV07-554	2515906.850	5303596.960	1150.720	133.7	Existing
Galena Hill	NV08-658	2515672.930	5303479.560	1153.620	166	New
Galena Hill	NV08-660	2515739.990	5303450.940	1150.980	178	New
Galena Hill	NV08-661	2515625.150	5303397.350	1139.720	322.1	New
Galena Hill	NV08-663	2515691.610	5303373.380	1138.160	292	New
Galena Hill	NV08-666	2515857.890	5303455.940	1149.820	220	New
Galena Hill	NV08-667	2515806.350	5303366.290	1138.130	232.1	New
Galena Hill	NV08-668	2515756.210	5303277.810	1131.670	277.1	New
Galena Hill	NV08-671	2515707.690	5303195.650	1131.600	355	New
Ginger Hill	NV07-405	2515091.180	5300526.890	1224.170	268.3	New
Ginger Hill	NV07-406	2514969.480	5300317.160	1246.380	352.1	New
Ginger Hill	NV07-407	2514715.320	5300697.540	1262.800	211.2	New
Ginger Hill	NV07-408	2514625.080	5300526.450	1259.200	202	New
Ginger Hill	NV07-409	2514361.260	5300861.610	1293.740	226.3	New
Ginger Hill	NV07-410	2515134.250	5300627.090	1214.320	160.1	New
Loma de La Plata	NV05-193	2512425.340	5303512.370	1243.550	299	New
Loma de La Plata	NV05-241	2511456.430	5303007.690	1363.450	118.5	Existing
Loma de La Plata	NV05-242	2511478.570	5303026.180	1358.410	70.5	Existing
Loma de La Plata	NV05-243	2511500.000	5303007.700	1353.900	95	Existing
Loma de La Plata	NV05-244	2511490.030	5302981.080	1355.030	71	Existing
Loma de La Plata	NV05-245	2511545.880	5303011.680	1342.280	89	Existing
Loma de La Plata	NV06-252	2511768.840	5303682.640	1263.450	407.21	New
Loma de La Plata	NV06-319	2511457.710	5302987.110	1363.340	62	Existing
Loma de La Plata	NV06-320	2511539.460	5303043.180	1346.360	113.5	Existing
Loma de La Plata	NV06-321	2511528.090	5303092.450	1343.430	82	Existing
Loma de La Plata	NV06-322	2511542.010	5303070.940	1344.000	89	Existing
Loma de La Plata	NV06-323	2511504.120	5303053.950	1351.990	118.5	Existing
Loma de La Plata	NV07-431	2511472.610	5303566.110	1274.000	256.5	New
Loma de La Plata	NV07-432	2511498.830	5303607.200	1270.430	166.2	New
Loma de La Plata	NV07-433	2511384.520	5303609.190	1276.890	222.8	New
Loma de La Plata	NV07-434	2511370.030	5303523.960	1285.440	188	New
Loma de La Plata	NV07-496	2511567.220	5303103.320	1335.770	65.8	Existing

Pan American Silver Corp:

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Loma de La Plata	NV07-497	2511591.000	5303077.990	1332.290	81.7	Existing
Loma de La Plata	NV07-498	2511610.990	5303150.220	1320.270	81.2	Existing
Loma de La Plata	NV07-499	2511631.530	5303100.230	1320.600	100.5	Existing
Loma de La Plata	NV07-500	2511678.120	5303096.310	1307.030	111.8	Existing
Loma de La Plata	NV07-501	2511663.130	5303147.090	1308.570	100.7	Existing
Loma de La Plata	NV07-502	2511623.600	5303197.840	1310.290	121.3	Existing
Loma de La Plata	NV07-503	2511671.070	5303204.580	1302.600	132.9	Existing
Loma de La Plata	NV07-504	2511655.030	5303246.610	1301.350	138.5	Existing
Loma de La Plata	NV07-505	2511695.240	5303250.820	1293.170	159.8	Existing
Loma de La Plata	NV07-506	2511597.240	5303253.360	1296.950	142.6	Existing
Loma de La Plata	NV07-507	2511543.240	5303253.960	1298.060	129.2	Existing
Loma de La Plata	NV07-508	2511552.930	5303300.330	1296.720	117.7	Existing
Loma de La Plata	NV07-509	2511486.570	5303197.320	1311.600	72.1	Existing
Loma de La Plata	NV07-510	2511467.130	5303353.510	1309.140	114.5	Existing
Loma de La Plata	NV07-511	2511480.350	5303449.180	1292.790	135.2	Existing
Loma de La Plata	NV07-512	2511577.380	5303450.770	1288.100	117.9	Existing
Loma de La Plata	NV07-513	2511725.820	5303095.030	1299.700	135.8	Existing
Loma de La Plata	NV07-515	2511693.280	5303047.760	1312.300	123.8	Existing
Loma de La Plata	NV07-517	2511704.170	5303152.360	1302.270	129.8	Existing
Loma de La Plata	NV07-519	2511713.170	5303201.400	1295.940	145	Existing
Loma de La Plata	NV07-522	2511651.700	5303303.320	1287.780	162.5	Existing
Loma de La Plata	NV07-526	2511601.280	5303303.130	1290.040	150.4	Existing
Loma de La Plata	NV07-529	2511711.960	5303295.450	1289.850	156.7	Existing
Loma de La Plata	NV07-532	2511745.140	5303248.310	1287.290	146.9	Existing
Loma de La Plata	NV07-535	2511796.750	5303251.170	1281.620	170.8	Existing
Loma de La Plata	NV07-537	2511761.150	5303148.590	1292.700	130.2	Existing
Loma de La Plata	NV07-540	2511802.900	5303149.690	1287.110	156	Existing
Loma de La Plata	NV07-543	2511739.070	5303052.860	1304.170	98.8	Existing
Loma de La Plata	NV07-546	2511789.020	5303051.110	1297.060	177.7	Existing
Loma de La Plata	NV07-547	2511616.860	5302949.090	1321.690	90.35	Existing
Loma de La Plata	NV07-549	2511702.480	5302949.410	1308.740	93.8	Existing
Loma de La Plata	NV07-550	2511890.960	5303251.450	1273.230	230.95	Existing
Loma de La Plata	NV07-555	2511571.520	5303349.900	1298.240	122.9	Existing
Loma de La Plata	NV07-557	2511670.910	5303352.000	1281.860	143.1	Existing

Pan American Silver Corp:

Deposit	Hole number	Collar Easting	Collar Northing	Collar Elevation	Depth	New or existing hole to Resource estimates
Loma de La Plata	NV07-559	2511764.870	5303347.310	1278.190	185.5	Existing
Loma de La Plata	NV07-564	2511866.250	5303350.500	1271.220	188.3	Existing
Loma de La Plata	NV07-566	2511981.950	5303351.330	1261.740	235	Existing
Loma de La Plata	NV07-569	2511906.630	5303148.310	1278.020	185.2	Existing
Loma de La Plata	NV07-571	2511926.070	5303447.490	1262.370	234.5	Existing
Loma de La Plata	NV07-575	2512044.000	5303454.960	1252.850	277	Existing
Loma de La Plata	NV07-579	2511832.070	5303449.620	1266.520	210.3	Existing
Loma de La Plata	NV07-581	2512131.960	5303448.420	1255.050	316	Existing
Loma de La Plata	NV07-586	2511550.440	5302903.230	1334.190	85	New
Loma de La Plata	NV07-588	2511520.150	5303642.760	1266.400	247	New
Loma de La Plata	NV07-591	2511545.160	5303688.960	1260.400	274	New
Loma de La Plata	NV07-592	2511459.320	5303735.380	1258.490	250	New
Loma de La Plata	NV07-594	2511433.440	5303693.520	1264.910	229	New
Loma de La Plata	NV07-597	2511805.740	5303301.800	1278.330	185.7	New
Loma de La Plata	NV07-598	2511905.400	5303296.750	1269.200	202	New
Loma de La Plata	NV07-601	2511517.850	5303400.870	1297.110	127	New
Loma de La Plata	NV07-602	2511617.550	5303399.750	1288.550	121.4	New
Loma de La Plata	NV07-604	2511719.900	5303399.270	1275.710	172	New
Loma de La Plata	NV07-605	2511820.050	5303400.010	1271.680	199	New
Loma de La Plata	NV07-607	2511922.910	5303400.060	1264.850	233.7	New
Loma de La Plata	NV07-609	2512014.410	5303403.920	1257.210	268	New
Loma de La Plata	NV07-611	2512115.710	5303398.350	1256.780	289	New
Loma de La Plata	NV07-616	2511650.310	5303304.720	1287.590	270.4	New
Loma de La Plata	NV07-620	2511651.170	5303301.720	1287.710	109	New
Loma de La Plata	NV07-621	2511669.060	5303354.770	1281.790	169	New
Loma de La Plata	NV07-622	2512231.930	5303452.330	1258.880	333.3	New
Loma de La Plata	NV07-625	2512279.570	5303549.890	1257.070	337.05	New
Loma de La Plata	NV07-626					