Technical Report on Preliminary Economic Assessment for the Halfmile-Stratmat Massive Sulphide Zinc-Lead-Silver Integrated Project Bathurst, New Brunswick, Canada

Report Prepared for

Trevali Mining Corporation

Report Prepared by

SRK Consulting (Canada) Inc.
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Cover: Halfmile Mine Portal

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Executive Summary

Introduction

The Halfmile-Stratmat integrated project is comprised of the Halfmile mine and the advanced exploration stage Stratmat project. The volcanogenic massive sulphide (VMS) deposits are located in the Bathrust Mining Camp in northeast New Brunswick, Canada, approximately 60 and 45 kilometres (km) southwest of the City of Bathurst and from 20 to 40 km from the historic Brunswick 12 mine respectively. It is approximately 22 km from Halfmile mine to the Stratmat property. During 2011-2012 approximately 125 thousand tonnes (kt) of mineralized material was trial mined from the Halfmile mine and treated in the Brunswick 12 processing plant.

Trevali Mining Corporation (Trevali) is a Canadian public company domiciled in Vancouver, British Columbia with shares listed on the TSX under the symbol TV.

SRK Consulting (Canada) Inc. (SRK) completed a mineral resource estimate for the Stratmat project, outlining five mineralized zones, documented in "Independent Technical Report for the Stratmat Lead-Zinc Project, Bathurst, New Brunswick", dated July 6, 2015 (SRK 2015). In April 2016, SRK was commissioned by Trevali to prepare a preliminary economic assessment (PEA) for an integrated project of the Halfmile Mine and the Stratmat project in collaboration with Trevali and independent consultant Stantec Consulting Ltd. (Stantec), which included an update of Halfmile mineral resource estimate.

This technical report summarizes the technical information that is relevant to support the disclosure of the PEA results for the integrated Halfmile-Stratmat integrated project pursuant to Canadian Securities Administrators' National Instrument 43-101 Standards of Disclosure for Mineral Projects. It provides a summary of the work completed by the independent consultants and Trevali. The opinions contained herein and effective October 26, 2017, are based on information collected by the various consultants throughout the course of their investigations.

Property Description and Ownership

The Halfmile-Stratmat integrated project consists of two non-contiguous claim blocks, the Halfmile and the Stratmat claim blocks. The Halfmile claim block consists of one mineral title comprising 59 claim units and one mining lease together covering 1,685.5 hectares (ha). Trevali, through Trevali (Maritimes) Ltd., a 100% owned subsidiary of Trevali, has a 100% in the mining lease but only a 61.51% interests in certain claims in the northern portion of the claims underlying the North zone mineralization.

The Stratmat claim block is comprised of 95 contiguous mineral claims units that are 100% held by Trevali (Maritimes) Ltd. The 95 claim units cover a total of 2,079 ha but because the claims overlap the pre-existing Heath Steele lease to the south, the effective area of the property is 1,827 ha.

Geology and Mineralization

The Halfmile-Stratmat integrated project is within the Bathurst Mining Camp (BMC) which occupies a roughly circular area of approximately 70 km diameter in the Miramichi Highlands of northern New Brunswick. The area hosts numerous mineral deposits and mineral occurrences, all hosted by Cambro-Ordovician rocks that were deposited in an ensialic back-arc basin. The project is underlain by a magnetic northeast-southwest trending sequence of predominantly felsic volcanic rocks and lesser sedimentary rocks which are host to all massive sulphide deposits on the property. Provincial government regional mapping projects have classified the rocks as belonging to the Flat Landing Brook Formation of the Middle Ordovician Tetagouche Group.

The sulphide minerals consist of disseminated and massive sphalerite-galena-pyrite and chalcopyrite. The sulphide minerals are fine to medium-grained, and are coarser than those typically found in deposits of the

Bathurst-Newcastle district. Disseminated mineralization, commonly of economic grade also occurs in the phyllitic sedimentary rocks as well as in the talc layers which locally grade into massive sulphide.

Exploration Status

The area has been heavily explored by Xstrata, and its predecessor companies, since the 1950's. The area was again extensively explored during the 1980's and 1990's when the Heath Steele Mine was in production.

In 1988, Noranda put an exploration decline into the Boundary deposit and collected a 3,000 tonnes bulk sample that was used to prepare a feasibility study for the Boundary deposit.

On January 6, 2012, Trevali initiated preliminary mining from the uppermost portions of the Halfmile deposit with toll-processing at Xstrata's Brunswick 12 mill. Four separate campaigns of mineralized material were processed through the Brunswick 12 mill plant to assess the response of the Halfmile mineralization materials. A total of approximately 114,000 tonnes of mineralized materials was processed during the four campaigns, with nominal throughput of 5,000 tonne per day (t/d) being processed.

In 2009, Wardrop (now Tetra Tech) estimated the mineral resource for the Stratmat deposit. The mineral resource estimate followed the guidelines outlined in NI 43-101 and it was estimated using inverse distance square interpolation method with MineSight 3D block modelling software.

In 2011, Wardrop (now Tetra Tech) estimated the mineral resource for the Halfmile deposit. The mineral resource estimate followed the guidelines outlined in NI 43-101 and was estimated using inverse distance square interpolation method with GEOVIA GEMSTM 3D block modelling software.

Between October 2011 and December 2014, Trevali drilled a total of 49,760 m in 139 holes on the two claim blocks.

Mineral Resource and Mineral Reserve Estimates

Block model quantities and grade estimates for the Halfmile-Stratmat integrated project were classified according to the CIM Definition Standards for Mineral Resources and Mineral Reserves (May 10, 2014) by Dr. Gilles Arseneau, PGeo. An appropriate independent qualified person as defined in NI 43-101.

For the Halfmile deposit, mineral resources were classified as Measured category if they were within ten metres of an existing mining opening. Mineral resources were considered for the Indicated category where blocks were estimated by at least seven composite samples from a minimum of three boreholes from the first interpolation pass. All remaining estimated blocks within the estimation domains are classified as Inferred.

For the Stratmat deposit, mineral resources were considered for the Indicated category where blocks were estimated by at least three composite samples from a minimum of two boreholes from the first interpolation pass. All remaining estimated blocks within the estimation domains are classified as Inferred.

Mineral resources are summarized in Table i and Table ii below.

There are no mineral reserves at the Halfmile-Stratmat integrated project.

Table i: Mineral Resource Statement*, Halfmile Project, Halfmile-Stratmat Integrated Project, New Brunswick, SRK Consulting (Canada) Inc., June 23, 2016

Category Underground**	Quantity (Mt)	Grade					Metal				
		Au g/t	Ag g/t	Pb %	Zn %	Cu %	Au M oz	Ag M oz	Pb M lbs	Zn M lbs	Cu M lbs
Measured	0.4	0.60	40	1.99	5.92	0.46	0.01	0.52	18	54	4
Indicated	7.4	0.29	35	2.37	7.00	0.16	0.07	8.45	389	1,146	26
Measured & Indicated	7.8	0.30	36	2.35	6.94	0.18	0.08	8.98	407	1,199	31
Inferred	6.5	0.10	23	1.51	5.62	0.15	0.02	4.72	216	806	21

* Mineral resources are not mineral reserves and do not have demonstrated economic viability. All figures are rounded to reflect the relative accuracy of the estimate. All composites have been capped where appropriate.

** Underground mineral resources are reported at a cut-off grade of 5% Zn equivalent. Cut-off grades are based on price for Au of US$1,250 per ounce, Ag is US$20.00 per ounce, Cu is US$3.00 per pound, Pb is US$0.95 per pound, and Zn is US$1.05 per pound, and exchange rate US$0.80 per Canadian dollar. A recovery of 88% was applied to Zn, 72% was applied to Pb, 50% was applied to Cu, 45% was applied to Ag, and 0% was applied to Au. The North zone is reported at 100% although only 61.5% of interest owned by Trevali.

Table ii: Mineral Resource Statement*, Stratmat Project, Halfmile-Stratmat Integrated Project, New Brunswick, SRK Consulting (Canada) Inc., May 20, 2015

Category Underground**	Quantity (Mt)	Grade					Metal				
		Au g/t	Ag g/t	Pb %	Zn %	Cu %	Au M oz	Ag M oz	Pb M lbs	Zn M lbs	Cu M lbs
Indicated	4.7	0.6	49	2.1	5.3	0.4	0.09	7.3	214	550	43
Inferred	2.4	0.4	39	2.1	4.8	0.7	0.03	3.0	110	252	37

* Mineral resources are not mineral reserves and do not have demonstrated economic viability. All figures are rounded to reflect the relative accuracy of the estimate. All composites have been capped where appropriate.

** Underground mineral resources are reported at a cut-off grade of 5% Zn equivalent. Cut-off grades are based on price for Au of US$1,300 per ounce, Ag is US$21.15 per ounce, Cu is US$3.00 per pound, Pb is US$1.00 per pound, and Zn is US$1.00 per pound, and exchange rate US$0.85 per Canadian dollar. A recovery of 88% was applied to Zn, 72% was applied to Pb, 50% was applied to Cu, 45% was applied to Ag, and 0% was applied to Au.

Mine Hydrogeology and Geotechnical

There is no specific hydrogeological study to support the designs of mine dewatering systems for the PEA. The PEA mine dewatering system designs are based on limited site data available and potentially analogous to Caribou Mine historical water inflow rates in the range of 13 litres per second (L/s) or 200 US gallons per minute for Halfmile underground and Stratmat underground.

There is no formal geotechnical study for the Halfmile project to support the PEA. SRK reviewed historical geotechnical information, previous trial mining mine design practices and stope production records, and concluded that the rock mass qualities range from fair for the hangingwall (HW) to good for the massive sulphide mineralization (MS) and footwall (FW), and the rock mass conditions are suitable for post pillar cut and fill (PPCF) or cut and fill (C&F) mining for the Upper zone (similar to the trial mining), and sublevel open stoping (SLOS) with delayed cemented rock fill (CRF) and/or unconsolidated rock fill (RF) for the Lower and Deep zones. Open stope dimensions were set at 20 m high by 20 m long by 10−20 m in width.

There is no dedicated geotechnical study for the Stratmat project to support the PEA. SRK reviewed geological and geotechnical core logging and other drill core information during the PEA. Structurally, the Stratmat project is highly complex on the mine scale. Preliminary rock mass clarifications show that the MS is overall fair rock masses, and the FW and HW range from poor to fair rock masses, overall fair rock masses. The Stratmat rock mass conditions are suitable for SLOS type underground mining (similar to the Halfmile Mine aforementioned).

All the underground SLOS mining will employ either CRF or RF; therefore, there is no permanently pillar left underground (PPCF mining is an exception).

Mining

Halfmile Project

At Halfmile, all run-of-mine (RoM) material will be mined by underground mining method. Sublevel open stoping (SLOS) and Sublevel Retreat (SLR) will be the main mining methods planned, supplemented by post pillar cut and fill (PPCF) and mechanized cut and fill (MCF) mining for Upper zone where mineralization dip angle is approximately at 39 degrees. All mining methods will employ either cemented or unconsolidated waste rock as backfill. The mine plan includes 92% of RoM tonnes from SLOS/SLR with down holes (up holes for sill pillar recovery) on 20 m sublevels and cemented or unconsolidated waste rock fill, and 8% of RoM tonnes from PPCF/MCF with unconsolidated waste rock and cemented waste rock (sill level stopes only). There is no permanent sill or rib pillar considered for the SLOS/SLR mining. Limited sill pillars were planned only for the two-trial mining opened mining fronts.

Access to the underground mine will be by an existing portal and ramp system developed previously to a depth of 170 m below surface. The ramp will be extended down to the mine bottom approximately 1,020 m below surface at a maximum gradient of -15% with dimensions of 5.0 m width by 5.0 m height, the same as the existing ramp.

Stope sequencing will generally be top-down block by block, and bottom-up within the mining block. On a mining level scale, both transverse primary-secondary stope sequence and longitudinal retreat mining will be employed, dependent on mineralization thickness. In the first year, RoM material will be sent to Caribou mill. From the second year onwards, RoM materials will be hauled by 45-tonne capacity trucks to surface then transported to Stratmat dense media separation (DMS) plant by surface trucks, where approximately 22% of RoM will be separated as waste for backfill and 78% of RoM as plant feed. Waste rock broken underground will be hauled by 30-tonne capacity ejector type trucks to empty stopes as backfill, or to surface temporary waste stockpile.

Backfill will be first sourced from development waste, shortage will be supplemented by back trucked Stratmat DMS separated waste.

Ventilation capacity is planned at 385 cubic metres per second (cms) or 815,000 cubic feet per minute (cfm) to support a maximum production rate of 2,800 tonnes per day (t/d), providing an estimated 18% contingency. Intake will be through an existing fresh air raise (FAR) which will be extended and supplemented by a larger raisebored FAR system. Exhaust will be through the main ramp and a planned return air raise (RAR) system that will also be raisebored.

Underground main sumps and pump stations will be spaced approximately 100 m vertical at the starting level of a mining front/block, staged pump to upper level main sumps and eventually to surface.

Stratmat Project

At Stratmat, RoM material will be mined by underground mining, too, similar to Halfmile underground mining except there is no PPCF/MCF mining method employed. RoM materials will be directly hauled by 45-tonne capacity underground trucks to Stratmat DMS plant for waste separation.

There will be two independent ramp systems to access Stratmat underground mineralization. The Main ramp system will be used to access the S1 (Shallow and Deep), S0, and S5 zones (main production system); and the Main zone ramp will be used to access the Main zone underground mineralization (supplement production system).

Backfill will be first sourced from development waste rock, supplemented by back trucked Stratmat DMS plant separated waste.

Ventilation is designed at 189 cms (400,000 cfm) for a production rate of 1,400 t/d for the main production system, providing an estimated 14% contingency. Intake will be through the Main ramp and a 3.6 m diameter of raisebored FAR, exhaust will be through a 4.5 m diameter of raisebored RAR.

Ventilation is designed at 42 cms (90,000 cfm) for the supplement production system. Intake will be through the Main zone ramp, exhaust will be through a 2.4 m diameter of raisebored RAR.

Underground dewatering strategy is similar to the Halfmile underground dewatering system.

Run-of-Mine Material in Mine Plan

There are no mineral reserves declared for the Halfmile-Stratmat integrated project. In the PEA, all mineral resources categories, including Measured, Indicated, and Inferred mineral resources, were considered for inclusion into the mine plans. The resource block models were used for the designs of mining shapes targeting all mineral resources within a mining shape above in situ net smelter return (NSR) cut-off values (CoVs) of $100/t for the Halfmile PPCF and CF, $85/t for the Halfmile SLOS, $80/t for the Stratmat SLOS, respectively, which were based on a zinc price of US$1.01/pound (lb), lead price US$0.91/lb, copper price US$2.86/lb, silver price US$17.33/ounce (oz), gold price US$1201.00/oz (no credit), exchange rate of US$0.84 per Canadian dollar, initial estimated total site costs of $90 for the Halfmile PPCF, $78 for the Halfmile SLOS, $73 for the Stratmat SLOS per tonne of RoM (including royalties), and initial metallurgical zinc recovery of 85%, lead recovery of 65%, copper recovery of 60%, silver recovery of 45%, and gold recovery of 0%. Mining recovery and dilution parameters were applied based on the selected mining methods and geotechnical considerations. External dilution ranges from 12% to 15% dependent on mining method. Mining recoveries vary from 95% to 98% dependent on stope category and mining method.

The estimated LoM RoM material is summarized in Table iii below. There are no mineral reserves at the Halfmile-Stratmat integrated project.

Table iii: Run-of-Mine Material Estimate for the Halfmile-Stratmat Integrated Project

Mine	Category	Run-of-Mine (DMS) Plant Feed						
		Tonnes (kt)	Zn (%)	Pb (%)	Cu (%)	Ag (g/t)	Au (g/t)	NSR ($/t)
Halfmile	Measured	155	6.06	2.12	0.44	39.46	0.63	143
	Indicated	5,592	6.22	2.18	0.11	32.27	0.25	136
	Subtotal Measured + Indicated	**5,747**	**6.21**	**2.18**	**0.12**	**32.46**	**0.26**	**136**
	Inferred	3,629	5.33	1.49	0.12	21.80	0.09	105
	Subtotal Inferred	**3,629**	**5.33**	**1.49**	**0.12**	**21.80**	**0.09**	**105**
Stratmat	Measured							
	Indicated	2,978	4.88	1.88	0.36	45.44	0.58	119
	Subtotal Measured + Indicated	**2,978**	**4.88**	**1.88**	**0.36**	**45.44**	**0.58**	**119**
	Inferred	657	4.92	2.07	0.65	35.76	0.38	133
	Subtotal Inferred	**657**	**4.92**	**2.07**	**0.65**	**35.76**	**0.38**	**133**
Total	Measured	155	6.06	2.12	0.44	39.46	0.63	143
	Indicated	8,570	5.75	2.08	0.20	36.85	0.36	130
	Measured + Indicated	**8,725**	**5.76**	**2.08**	**0.20**	**36.89**	**0.37**	**130**
	Inferred	**4,286**	**5.27**	**1.58**	**0.20**	**23.94**	**0.13**	**109**

* Figures have been rounded.

** The estimated run-of-mine is partly based on Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the preliminary economic assessment based on these mineral resources will be realized.

*** The reader is cautioned that the mineralized material should not be misconstrued as a mineral resource or a mineral reserve. The quantities and grade estimates are derived from the block model and include mining dilution and losses.

Mine Production Schedule

Halfmile Project

The Halfmile underground mine will be owner operated from start-up to the end of mine life (Q4 2032) with the exception of a Contractor ramp development crew which is expected to be on site for 3.5 years. The goal of the Contractor ramp crew is to develop the main ramp and critical infrastructure required to bring the first three mining blocks of the Lower zone into production in a timely manner. Monthly LoM development and

production schedules were prepared and consolidated into an annual schedule for reporting. The underground mine pre-production period is defined as a 3-year period from January 1, 2020 to December 31, 2022. In 2023, the average RoM production rate will be 1,635 t/d, which is approximately 63% of the designed underground mine capacity. The mining production period extends from January 1, 2023 to December 2032 for 10 years. At full production, the planned mining rate is 2,600 t/d or 910,000 tonnes per annum (tpa). Additional annual development has been scheduled so that once Stratmat closed, Halfmine will be able to increase production to 2,800 t/d or 980,000 tpa for 2 years before production starts to taper off.

The LoM total RoM material is 9,376 kt at $124/t net smelter return (NSR).

LoM lateral development is estimated at 40,000 m, including 24,800 m capitalized and 15,200 m expensed. LoM vertical development is estimated at 4,700 m, all capitalized. The owner lateral development advance rate was scheduled to a maximum of 420 m/month, or 140 m/month/jumbo. The contractor lateral development advance rate was scheduled to a maximum of 192 m/month assuming that the contractor will be properly resourced and supported to achieve these rates and may blast at will. Production rates in the Upper zone during this time period are reduced to account for the delays this will cause.

LoM waste rock broken is approximately 2,471 kt. Halfmile underground waste rock backfill requirement is 5,162 kt, supplied by 2,471 kt development waste, 2,691 kt DMS reject waste. There will be no waste rock left on the surface in the end of the mine life. Definition drilling costs are budgeted but no detailed definition drilling plan has been prepared.

Stratmat Project

The Stratmat Mine will consist of two separated underground mining systems – a main production system and supplement production system (Main zone mineralization). In the first two years from 2020 to 2021, the main production system will be contractor operated in order to speed up underground development and production ramp-up, then contactor mining will be transitioned to owner mining from 2022 to the end of mine life on 2029. Monthly LoM development and production schedules were prepared and consolidated into an annual schedule for reporting. The underground mine pre-production period is defined as a 2-year period from January 1, 2020 to December 31, 2021. In the end of 2021, all the underground major infrastructure to support the mine plan will be in place and in 2022 the average RoM production rate will be 1,162 t/d, which is approximately 90% of the designed underground mine capacity. The mining production period extends from January 1, 2022 to Q4, 2029 for eight years. At full production, the planned mining rate is 1,400 t/d or 490,000 tpa. The LoM total RoM material is 3,635 kt at $122/t NSR.

LoM lateral development is estimated at 25,000 m, including 16,400 m capitalized and 8,600 m expensed. LoM vertical development is estimated at 1,700 m, all capitalized. The maximum lateral development advance rates were scheduled the same rates as Halfmile. LoM waste rock broken is approximately 1,581 kt. Stratmat underground waste rock backfill requirement is 1,946 kt. Backfill will be first sourced from underground development waste, supplemented by back trucked Stratmat DMS plant separated waste rock. There will be no waste rock left on the surface in the end of the mine life. Definition drilling costs are budgeted but no detailed definition drilling plan has been prepared.

Metallurgy and Processing

The PEA is based on the construction of a new concentrator at the Stratmat site to process both the Stratmat mineralization and the Halfmile mineralization which will be trucked to the Stratmat site. The new concentrator will have a capacity of 3,000 t/d and employ conventional differential flotation technology to produce three saleable metal concentrates of zinc, lead, and copper. For both the metallurgical performance and the operating costs of a new concentrator, reference has been made to the current operations of Trevali at the nearby Caribou Mine.

The design of the Stratmat-Halfmile integrated project flowsheet is based on metallurgical testwork that has been completed initially on Stratmat mineralization in 1998 by Noranda with short term, plant scale, batch test milling of the Halfmile deposit in 2012 at the Brunswick mill. In 2015 and 2016-2017 bench scale metallurgical work was completed on a combined sample of Stratmat and Halfmile to establish the main processing parameters of the mineralization. Preliminary testwork was also carried out on a mining sample of

Halfmile to investigate the potential benefits of applying dense media separation on the RoM materials to reject barren materials before the concentrator. Table iv shows the metallurgical parameters derived from the testwork for the flowsheet design as well as the metallurgical results anticipated from the operation.

As experienced with other Bathurst style of mineralization, the Stratmat and Halfmile sample showed the requirement of fine grinding to liberate the minerals, although significantly less than the requirement for the existing Caribou plant feed. The new Stratmat concentrator will initially grind the mill feed material to a P80 of 72 microns with the application of Isamills for regrinding within the flotation circuit which will help control contamination with iron grinding media within the flotation concentration stages.

The Stratmat concentrator will have a DMS circuit integrated into the concentrator flowsheet to reject barren rock from the RoM prior to primary grinding. The preliminary testwork has indicated that a 22% weight rejection could be achieved for both deposits. This material will be used as backfill in the mining operations.

The capital cost of the 3,000 t/d concentrator is estimated at $ 86.6 million and the DMS capital cost is estimated at $12.5 million, including 25% contingency. The operating cost of the concentrator is estimated to be $26.79/t-milled ($21.04/t-mined), including DMS operating cost.

Table iv: Predictive Metallurgy

	Grades				Recoveries			
	Zn (%)	Cu (%)	Pb (%)	Ag (g/t)	Zn (%)	Cu (%)	Pb (%)	Ag (%)
Feed	6.99	0.25	2.39	41				
Zn Conc	50.0	0.21	2.53	70	**85.3**	10.0	12.6	20.5
Cu Conc	3.83	20.0	9.50	150	0.3	**40.1**	2.0	**1.8**
Pb Conc	8.93	1.32	45.2	696	4.4	18.1	**65.0**	**58.8**
FinalTails	0.84	0.09	0.58	9	10.1	31.8	20.4	18.9

Project Infrastructure

The basic infrastructure required for the Halfmile project is in place, and has been kept in a serviceable state since the mine put in care and maintenance in late 2012. Temporary power has been maintained and heat has been supplied to buildings that could not otherwise be protected against freezing.

With replacement of new surface fan and heat house as well as minor repair or rehabilitation, the surface infrastructure supporting the underground mine can be restored to an operating state for the mine re-opening. With underground mine dewatering in progress and expected limited underground rehabilitation, development and PPCF stoping work will be started to prepare for production start-up. No new major underground infrastructure is needed in the early years of production.

The Stratmat Mine is a green field project. The mine and the Stratmat DMS plant will be close by each other. Access roads, powerline, ventilation fans, portals, waste and RoM stockpile pads, water management plant, and other required surface infrastructure have been planned and costed to support development of Stratmat Mine and DMS plant sites.

The Stratmat DMS plant is a multi-level structure adjacent to and integrated into the grinding circuit of the concentrator for the base case scenario.

Power supply will be through construction of a new t substation, which will be connected to the existing Health Steele substation located approximately 2-3 km away. A new powline from the Stratmat substation to Halfmile Mine site will be also constructed to supply the Halfmile Mine site requirements.

Market Studies and Contracts

Zinc, lead and copper concentrate offtake agreements are in place with Glencore plc, a large, diversified resource conglomerate and commodity trader, for the life of the project feed at International Benchmark terms, as defined by average respective commodity price on the London Metal Exchange for the relative shipping period.

The following contracts will be part of the construction and/or operation of the Halfmile-Stratmat integrated project:

- In the first three years, Halfmile ramp development and longhole open stope production ramp-up will be conducted by a mining contractor;
- In the first two years, Stratmat Mine development and longhole open stope production ramp-up will be conducted by a mining contractor;
- Production drilling and blasting;
- Halfmile surface RoM material transportation from Halfmile to Stratmat DMS plant and back trucking waste rock backfill materials;
- Surface trucking DMS productions from Stratmat to Caribou mill.

SRK has not reviewed any of these contracts or documents related to tendering.

Social and Environmental Aspects

The Halfmile-Stratmat integrated project is located in the Bathurst Mining Camp which has a rich mining history. The former Brunswick mine was a significant global zinc producer prior to its closure in 2013. With the closure of Brunswick-12 mine, and the recent re-opening of the Caribou mine, the area has a large pool of experienced personnel, contactors and service providers available to service the project.

The current PEA proposes underground mining at both Halfmile and Stratmat. During the first year of operation, RoM material will be trucked and processed at the Caribou Mine concentrator. From year two, all RoM material will be processed in a DMS unit located at Stratmat and will then be processed at Stratmat concentrator for the base case scenario. All waste rock produced at both Halfmile and Stratmat will be used to meet backfill requirements underground. Waste rock will be temporarily stored on lined Waste Rock Storage Facilities (WRSFs) until it is transferred underground for permanent storage. A tailings management facility will be required in the Stratmat location with capacity to manage the tailings anticipated from the LoM of both Stratmat and Halfmile underground operations.

The Halfmile Mine received a certificate of determination in December of 2010 (File #4561-3-1253) under the New Brunswick Environmental Impact Assessment Regulation for the construction and operation of the Halfmile Mine site. Environmental infrastructure such as a mine water treatment plant, holding ponds, a sewage treatment facility, and WRSFs are present at Halfmile. The mine successfully operated between January and July of 2012 during a trial mining and production period. The RoM material from Halfmile was trucked to the former Brunswick 12 milling complex for processing while waste rock was stored underground at Halfmile and allowed to flood. The re-opening of the Halfmile Mine will make use of the existing environmental infrastructures on an already disturbed site.

The Stratmat project is currently subject to advanced exploration activities. No infrastructure is currently present at Stratmat. An EIA registration (at a minimum) will be required to construct and operate the proposed Stratmat milling complex, TMF, and the mine. Environmental infrastructure required for the proposed Stratmat Mine will include: a mine water treatment plant, holding ponds, a sewage treatment facility, two WRSFs and a TMF. Going forward there may be an opportunity to leverage the adjacent Heath Steele brown-field site which is subject to an option agreement between Trevali and partner Glencore.

At present, monies are being held in security for the Halfmile Mine by the province. The reclamation assets currently on file with the province total $325,160. Based on the current PEA cost estimates, an additional

$17,238,472 reclamation security bond would be required on file with the New Brunswick Department of Energy and Resource Development (NBDERD) prior to mine development.

Capital and Operating Cost Estimates

Capital and operating costs are presented in Canadian dollars as at the fist quarter of 2017.

The Halfmile-Stratmat integrated project total capital cost estimate for the base case scenario (constructing a new mill at Stratmat) is $417.9 million, comprised of $230.5 million ($156.6 million for Stratmat site and 73.9 million for Halfmile site) in pre-production capital and $187.3 million in sustaining capital over the remaining life of the project. Many costs within the PEA are based on Caribou's 2016 actuals and direct supplier/contractor quotations including the following:

- Major mine mobile equipment quotations;
- Material supply quotations;
- Surface transportation cost;
- Consumables - fuel, power and explosives.

The capital cost estimates were prepared to an accuracy level of +40%/-30%. The infrastructure capital cost estimates include a 25% contingency. Cost estimates for the underground mine are based on contractor and owner operations from start-up to Q4 2032 based on activities will perform.

Site operating costs averaging $71.88 per tonne mined for the base case scenario are estimated for the period from January 1, 2020 through to December 31, 2032, which consists of $33.44/t-mined mine operating cost for Stratmat and $38.24/t-mined mine operating cost for Halfmile, $21.04/t-mined mill operating cost, and $13.94/t-mined general and administration (G&A) operating cost.

The Halfmile-Stratmat integrated project total capital cost estimate for the alternative case scenario (modifying Caribou mill) is $332.1 million, comprised of $155.6 ($79.5 million for Stratmat and Caribou sites and 76.1 million for Halfmile site) million in pre-production capital and $176.5 million in sustaining capital over the life of the project.

Site operating costs averaging $73.46 per tonne mined for the alternative case scenario are estimated for the period from January 1, 2020 through to December 31, 2032, which consists of $33.44/t-mined mine operating cost for Stratmat and $38.48/t-mined mine operating cost for Halfmile, $20.26/t-mined mill operating cost, and $16.13/t-mined general and administration (G&A) operating cost.

Indicative Economic Results

The Halfmile-Stratmat integrated project has been evaluated on a discounted cash flow basis. The cash flow analysis was prepared on a constant 2017 Canadian dollar basis. No inflation or escalation of revenue or costs has been incorporated. The base case assumed metal prices are zinc price of US$1.15/lb, lead price of US$0.95/lb, copper price of US$2.72/lb, silver price of US$19.00/oz, gold price of US$1283.85/oz (no credit), and exchange rate of US$0.79 per Canadian dollar.

The financial analysis performed as part of this PEA shows the following indicative economic results:

For the base case scenario (constructing a new mill at Stratmat), the pre-tax present value of the net cash flow with an 8% discount rate (NPV8%) is $166 million using the base case metal prices. Project post-tax NPV8% at the base case metal prices is $99 million. The internal rates of return (IRR) are respectively 23% pre-tax and 19% post-tax.

For the base case scenario, the pre-tax and post-tax payback periods are expected to be approximately 3.4 and 3.6 years respectively at the base case metal prices, start from both Stratmat Mine and Mill put into commercial production (2022).

For the alternative case scenario (modifying Caribou mill), the pre-tax present value of the net cash flow with an 8% discount rate is $222 million using the base case metal prices. Project post-tax NPV8% at the base case metal prices is $116 million. The internal rates of return (IRR) are respectively 34% pre-tax and 25% post-tax.

For the alternative case scenario, the pre-tax and post-tax payback periods are expected to be approximately 2.6 and 2.9 years respectively at the base case metal prices, start from both Stratmat Mine and DMS plant put into commercial production (2022).

The key economic indicators of NPV8% and IRR are most sensitive to changes in metal prices then exchange rate. This is attributed to the fact that metal prices and exchange rate affect directly the entire revenue stream. The project is slightly more sensitive to changes in operating costs than to capital costs.

This PEA is preliminary in nature. The results of the economic analysis performed as a part of this PEA are based in part on Inferred mineral resources. Inferred mineral resources are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the PEA will be realized.

Conclusion and Recommendations

This PEA was prepared by a group of independent consultants supported by Trevali to demonstrate the economic viability of an integrated project. The base case of the project includes two underground mines, a DMS plant, a concentrator and a TSF, targeting all mineral resources defined in the Halfmile and Stratmat projects. This technical report provides a summary of the results and findings from each major area of investigation to a level that is considered to be consistent with that normally expected for a PEA of a resource development project.

The results of the PEA indicate that the integrated project including re-opening of the proposed Halfmile Mine, newly constructed Stratmat Mine and Stratmat DMS plant, and a Stratmat concentrator and a TSF (modified Caribou mill complex for the alternative case) has financial merit at the base case metal price assumptions considered. The results are considered sufficiently reliable to guide Trevali's management in a decision to advance the project to a prefeasibility study.

Analysis of the results of the investigations has identified a series of risks and opportunities associated with each of the technical aspects considered for the development of the proposed project.

The key risks include:

- Approximately 34% by tonnage or 32% by NSR value of the run-of-mine materials / plant feed is from Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the PEA based on these mineral resources will be realized.
- There is a risk of increased external dilution beyond the planned amount. This would reduce the mill head grade and have a negative impact on revenue.
- There is a risk that the predictive metallurgy associated with DMS and/or mill will not be consistently achieved with a negative impact on the revenue.
- The Halfmile Mine site is a fully permitted facility that allows for mining under the existing certificate of approval, while the Stratmat Mine, DMS plant, concentrator and TSF will need different permits, any delay of the prerequisite permits will negatively affect the project start time and PEA economic results.

The key opportunities include:

- Exploration potential to increase the mineral resources of the Halfmile and Stratmat properties with additional drilling targeting the deep extension below the currently defined mineralization zones for both properties, and Stratmat S1 Shallow zone.
- Further stope design optimization will lead to reduced internal dilution and increased plant feed head grades.

- Further detailed mine planning work could possibly introduce more mineralized material into the mine plan. SRK estimateds that 5-10% of more mining resources could be brought in the mine plan.
- Further definition drilling should convert some of the existing Inferred mineral resources to Indicated or Measured category. This will be a benefit for future higher level technical studies.
- There is a potential to improve the predicted metallurgical forecast for the project plant feed through additional metallurgy test work and optimization of the plant flow sheet.
- There is a potential using different technology to construct a precondition plant to reject more percentage of waste with lower metal losses to increase mill feed head grade and improve project economics. Trevali scheduled additional test work is currently on-going.
- There is a potential to bring Halfmile North zone mineralization into the future mine plan and improve the project economics. Trevali owns 61.5% interest of the North zone. To simplify the current PEA, SRK was instructed by Trevali to exclude the North zone in the PEA mine plan.
- Utilization of the adjacent Heath Steele site and/or infrastructure may have the potential to further de-risk the project and add to potential future Mill feed.

Analysis of the results and findings from each major area of investigation suggests several recommendations to be considered during the next study stage of the project, including:

- Continue exploring the Halfmile-Stratmat integrated project. More specifically: 1) carry out additional metallurgical testing of the mineralized zones to determine their recoverability; 2) target 10 holes on the S1 Shallow zone at Stratmat to better define the geological continuity of this narrow mineralization; 3) drill 8 to 10 holes on the S1 Deep zone at Stratmat to better identify mineralization in the north limb of this zone; 4) target an additional 10 holes on Halfmile Lower zone to better define the geological control of the mineralization. The cost of the combined phases of work is expected to cost $1.2 million.
- Perform a prefeasibility level of Stratmat geotechnical study to support next stage of Stratmat Mine deign. An estimated $80,000 cost will be needed.
- Perform a prefeasibility level of Stratmat Mine hydrogeological study to support next stage of Stratmat Mine dewatering system design. An estimated $60,000 cost will be needed.
- Perform a prefeasibility level of Halfmile Lower zone and Deep zone geotechnical study to support next stage of Halfmile Mine design. An estimated $80,000 cost will be needed.
- Perform a prefeasibility level of Halfmile Mine hydrogeological study to support next stage of Halfmile Mine dewatering design. An estimated $50,000 cost will be needed.
- Evaluate Halfmile Mine primary access options between ramp and shaft for the extraction of Lower zone and Deep zone mineralization. A more comprehensive trade-off study is needed.
- Carry out prefeasibility level of study of DMS test work and mill metallurgy testing work. A DMS pilot plant testing may be needed. An estimated $100,000 cost will be needed.
- Continue discussion with provincial department on additional permits required by the integrated project.
- Review certificate of authorization permit conditions regularly to ensure compliance is achieved and condition deadlines are met.
- Engineering and Planning studies should commence in as early as possible for the environmental infrastructure and design as follows:
    - Site Geotechnical Investigation to assess infrastructure foundations and borrow sources
    - Hydrogeological studies including water balance, surface and groundwater models
    - Detailed testing of waste rock for acid generating potential
    - Environmental Assessment
- Alternative Assessment for TSF should be considered.
- Approvals to operate for Halfmile should be updated and reviewed regularly.
- Approval to operate should be obtained for Stratmat and reviewed regularly.
- Stratmat should be registered under EIA and MMER regulations.

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1 Introduction and Terms of Reference

1.1 General

The Halfmile-Stratmat integrated project is an advanced exploration stage volcanogenic massive sulphide (VMS) project situated in the Bathurst Mining Camp of northern New Brunswick, Canada. The project anticipates re-opening of the Halfmile underground mine with a targeted production rate of 2,600 tonnes per day (t/d), constructing a new Stratmat underground mine (1,400 t/d) and a Stratmat dense media separation (DMS) and 3,000 t/d concentrate plant. An alternative case examines the potential to truck pre-concentrated material to theexisting Caribou processingplant.

At the Halfmile site, considerable infrastructure is already in place as a result of 2011 to 2012 test mining campaign. At Stratmat, the project area is at a greenfield status; however, it is in the vicinity of the historical Heath Steele Mine that has roads, power, and other public infrastructure that is subject to an option agreement between Trevali and partner Glencore plc.

The Stratmat project mineral resource estimate was the subject of a technical report prepared by SRK in July 2015 (SRK 2015). This report restates the mineral resources for the Stratmat project and presents an updated mineral resource for the Halfmile project. The Halfmile and Stratmat projects are located approximately 60 and 45 km southwest of Bathurst, respectively. The two deposits are located on non-contiguous claim blocks approximately 20 km apart. Because they will share common infrastructure, the non-contiguous claim blocks form a single mineral property as defined under the Canadian Securities Administrators' National Instrument 43-101 Standards of Disclosure for Mineral Projects (NI 43-101).

Trevali Mining Corporation (Trevali), a zinc-focused base metal mining company, through its 100% owned subsidiary Trevali Mining (Maritimes) Limited owns a 100% interest in the Halfmile and Stratmat projects except North zone at Halfmile. Trevali's partner, Glencore, has the first right and option to purchase all or any portion of the concentrate off-take, as well as a 2% Net Smelter Return (NSR) royalty from both projects. Trevali only has a 61.51% interests in certain claims in the northern portion of the Halfmile claim blocks (which was not utilized in this study) and a portion of the Stratmat claim block is subject to a 2.5% NSR royalty to Teck Resources Limited.

In April 2016, SRK was commissioned by Trevali to prepare a NI 43-101 preliminary economic assessment (PEA) for the integrated project including both Halfmile and Stratmat projectss based on update of Halfmile geological and mineral resource model and 2015 Stratmat geological and mineral resource model, by working jointly with Trevali and Stantec Consulting Ltd. (Stantec), which was directly contracted by Trevali.

The purpose of this technical report is to document the results of the PEA for the Halfmile-Stratmat integrated project prepared by SRK with contributions from Trevali and other independent consultants. It was prepared following NI 43-101 and Form 43-101F1 Technical Report and Related Consequential Amendments guidelines.

This report has been compiled by Mr. Benny Zhang, PEng, MEng, with SRK's Toronto office during the months of August to December, 2016, April to July and October 2017.

1.2 Scope of Work

SRK's scope of work included:

- Management of SRK's own work
- Update of Halfmile geological and mineral resource block model and mineral resource statement
- Review existing Halfmile and Stratmat geotechnical and hydrogeological information and provide PEA level of mine design guidelines
- Selection of mining methods and mine development strategy for the integrated project
- Completion of Halfmile and Stratmat 3-D mine designs and life-of-mine (LoM) plans based on SRK 2015 Stratmat mineral resource block model and the current PEA updated Halfmile mineral resource block model
- Supervision of metallurgy test work programs which was directly contracted by Trevali to RPC Science & Engineering (RPC), an independent third-party service provider
- Review of historical and 2016 metallurgical testing results, forecast of mill metallurgy recoveries, and proposal of metallurgy recovery methods
- Cost estimates related to mining and mineral processing
- Review of third-party consultant and Trevali's corresponding work compiled in the technical report including cost estimates (environmental, permitting, tailings and waste rock management, surface infrastructure, general and administration, etc.)
- Construction of the integrated project cost models and economic model with compilation of Stantec and Trevali's cost estimates
- Compilation of a NI 43-101 compliant technical report describing the PEA for the Halfmile-Stratmat integrated project by incorporating the work of Trevali and the work of other independent consultants separately commissioned by Trevali

1.3 Basis of Technical Report

This PEA technical report is based on the following sources of information:

- July 6, 2015, SRK technical report, "Independent Technical Report for the Stratmat Lend-Zinc Project, Bathurst, New Brunswick" (SRK 2015)
- Inspection of the Halfmile and Stratmat project areas during four separate site visits, including outcrop and drill core
- Review of exploration data collected by Trevali
- Technical and cost information provided by Stantec
- Technical and cost information provided by Trevali
- Technical information provided by RPC
- Technical information provided by SGS Canada Inc. (SGS)
- Technical and cost information provided by FLSmidth (UK) Ltd. (FLSmidth)
- Discussions with Trevali technical and management personnel
- Additional information from public domain sources

The terms "potential mining resources" and "run-of-mine" (RoM) materials are used interchangeably in this PEA technical report to represent portions of the mineral resources that have had mining parameters applied to them including cut off criteria, external dilution, and mining losses, which are the basis of LoM production plan.

The term "plant feed" and "DMS product" are used interchangeably in this PEA technical report to represent portions of RoM materials sent to mill plant for processing.

Unless otherwise stated, this PEA technical report is based on Canadian currency and metric units of measure.

1.4 Qualified Persons

The compilation of this PEA technical report was undertaken by Mr. Benny Zhang, PEng, MEng, of SRK. By virtue of his education, membership to a recognized professional association, and relevant work experience, Mr. Zhang is an independent qualified person (QP) as defined by NI 43-101.

In accordance with NI 43-101 guidelines, the following professionals, designated as QP for the purpose of this technical report, have provided contributions as authors for certain sections of this report related to their areas of expertise. General areas of responsibility are listed here, with detailed lists of responsibility provided in Table 1 and the QP certificates.

Table 1: Qualified Persons and Responsible Report Sections

Qualified Person	Responsible Sections of the Report
Benny Zhang	Sections 1 to 2, 4, 14, 15, 18, 21 to 22; co-responsible for executive summary (ES) and Sections 23-26
Gary Poxleitner	Sections 20; co-responsible for ES and Sections 23-26
Gilles Arseneau	Sections 3.1-3.2, 5 to 11, 13; co-responsible for ES and Sections 24-26
Ross MacFarlane	Sections 12, 16; co-responsible for ES and Sections 23-26
Paul Keller	Section 17; co-responsible for ES and Sections 23-26
Jeffery Barrett	Section 3.3-3.5,19; co-responsible for ES and Sections 20, 23-26

Mr. Benny Zhang, MEng, **PEng** (PEO #100115459), is a principal mining engineer employed by SRK and has more than 33 years of experience in mining studies, planning and design, mine operations, and teaching and research in North America, South America, Europe, Africa, and Asia. Prior to joining SRK, he worked with AMEC Americas where he was involved in scoping, prefeasibility, feasibility, geomechanical studies, ground control, technical review, technical due diligence audit, and natural resource valuation projects. He has held research assistant and teaching assistant posts at McGill University where he was involved in applied rock mechanics for mine planning research projects and courses in mine development and services as well as materials handling. Mr. Zhang is the principal author and represents SRK taking overall responsibility for this technical report.

Dr. Gilles Arseneau, PGeo (APEGBC #23474), is an associate consultant with SRK, specializing in the area of geology and mineral resource estimation. Dr. Arseneau prepared the report sections on the project history, deposit geology, drilling and sampling, and mineral resource estimation both for Halfmile and Stratmat projects. He is the independent QP taking responsibility for the geology and Mineral Resource Statement.

Mr. Gary Poxleitner, PMP, **PEng** (PEO #100015286) is a principal mining engineer employed by SRK with over 25 years of operations and engineering underground experience. He is uniquely positioned to provide expertise in mine evaluation and mine costing, technical studies, innovative design, material handling, due diligence, internal audits, and operation improvement. His experience is primarily in gold, silver, diamonds, salt, and base metals. He has worked extensively with underground VMS polymetallic mines within his career. Mr. Poxleitner was the main contributor and takes overall QP responsibility in the areas of project capital and operating costs.

Mr. Ross MacFarlane, PEng (PEO #28062503), is an associate consultant with SRK with 35 years of varied experience in the mining industry with particular expertise in metallurgy. He has operations experience from first line production supervision to senior technical roles to mine site management, and project development roles from feasibility to construction and start-up. Mr. MacFarlane has worked with various commodities including iron, gold, nickel, uranium, copper, lead, zinc, platinum group minerals and industrial minerals. His career has taken him to North America, Europe, Africa, Asia, and South America. Mr. MacFarlane was the main contributor and takes QP responsibility in the areas of mineral processing and metallurgical testing, and recovery methods including processing cost estimates.

Mr. Paul Keller, PEng (PEO # 90101775), is the chief operations officer of Trevali and has extensive development project and mine operations experience in Canada with 29 years of experience most recently as manager of technical services for a major Canadian mining contractor where he led a team of engineers and designers on various mining contracts for major mining companies. Mr. Keller began his career with Rio Algom Limited and has also worked in various management roles with Barrick Gold's Hemlo mine in operations, engineering and maintenance. Mr. Kell is not independent from Trevali. Mr. Keller was the main contributor and takes QP responsibility in the areas of project surface infrastructure including related capital cost and project general and administration cost estimates.

Mr. Jeffery Barrett, PEng (APEGNB # M6890), is a geotechnical engineering consultant with Stantec Consulting Ltd. Mr. Barrett is the QP taking responsibility for environmental, permitting, social impact, and project infrastructure (environmental related) including related cost estimates.

Additional contributions to this PEA technical report were provided by:

- Mr. Steve Taylor, MSc, PEng, (SRK) Halfmile Mine design and planning
- Mr. Todd Hamilton, PGeo, (SRK) mine hydrogeology
- Mr. Marek Nowak, PEng, (SRK) geological and mineral resource estimation review
- Dr. Peter Wells, (SRK associate) metallurgical testing, processing, recovery methods
- Cam Scott, MEng, PEng, (SRK) environmental, social, and permit review
- Tim Kingsley, PGeo, (Trevali) key contact of Trevali during the PEA, geology and mineral resource estimation review
- Eric Arseneau, MES, (Stantec) environmental, social, and permit review
- Mr. Daniel Marinov, PGeo, VP exploration of Trevali, geology and mineral resource estimation review
- Anna Ladd, MA, CPA, CFO of Trevali, federal and provincial tax calculations

1.5 Qualifications of SRK and SRK Team

The SRK Group comprises of more than 1,400 professionals, offering expertise in a wide range of resource engineering disciplines. The independence of the SRK Group is ensured by the fact that it holds no equity in any project it investigates and that its ownership rests solely with its staff. These facts permit SRK to provide its clients with conflict-free and objective recommendations. SRK has a proven track record in undertaking independent assessments of mineral resources and mineral reserves, project evaluations and audits, technical reports and independent feasibility evaluations to bankable standards on behalf of exploration and mining companies, and financial institutions worldwide. Through its work with a large number of major international mining companies, the SRK Group has established a reputation for providing valuable consultancy services to the global mining industry.

1.6 Site Visit

The following QPs visited the project site as described below:

- Mr. Zhang visited the project sites from July 7 to 9, 2015, to view the overall project site, collect relevant information from Halfmile and Stratmat project sites. Mr. Zhang attended the project kick-off meeting held at Trevali's Caribou Mine from April 26 to 28, 2016, and also visited Caribou underground operations and collected all relevant information for the PEA project.
- Dr. Arseneau visited Stratmat project site from November 24 to 25, 2014 and visited Halfmile project site from May 27 to 28, 2016, to review the digitalization of the exploration database and validation procedures, review exploration procedures, define geological modelling procedures, examine drill core, interview project personnel, and collect all relevant information for the preparation of a revised mineral resource model. During the visits, particular attention was given to the treatment and validation of drilling data.
- Mr. MacFarlane visited the project sites from November 1 to 3, 2016, to discuss the metallurgical testwork, view diamond drill core and collect Caribou mill plant recent operating cost information.
- Mr. Barrett inspected the project sites on a number of occasions since 2008, and most recently on October 2, 2013, to evaluate closure costs for the project.
- Mr. Keller visited site on a regular basis and most recent visit to site was September 2016.
- Mr. Poxleitner has not visited the project sites yet. He based on other SRK professionals' site visit knowledge to support his QP site visit requirements.
- Mr. Hamilton has not visited the project sites yet. He based on other SRK professionals' site visit knowledge to support his QP site visit requirements.

All independent consultants were given full access to relevant data and conducted interviews with Trevali personnel to obtain relevant project information.

1.7 Acknowledgement

SRK would like to acknowledge the support and collaboration provided by Trevali personnel for this assignment.

1.8 Declaration

SRK's opinion contained herein and effective **on October 26, 2017**, is based on information collected by SRK throughout the course of SRK's investigations, which in turn reflect various technical and economic conditions at the time of writing. Given the nature of the mining business, these conditions can change significantly over relatively short periods of time. Consequently, actual results may be significantly more or less favourable.

This report may include technical information that requires subsequent calculations to derive subtotals, totals, and weighted averages. Such calculations inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, SRK does not consider them to be material.

SRK is not an insider, associate or an affiliate of Trevali, and neither SRK nor any affiliate has acted as advisor to Trevali, its subsidiaries or its affiliates in connection with this project. The results of the technical review by SRK are not dependent on any prior agreements concerning the conclusions to be reached, nor are there any undisclosed understandings concerning any future business dealings.

2 Reliance on Other Experts

SRK relied on the expertise of Trevali's Chief Financial Officer, Anna Ladd, in the modelling of the taxes and royalties section of the PEA financial model.

Financial results are reported in Section 21 of this report.

SRK has not performed an independent verification of land title and tenure information as summarized in Section 3. SRK did not verify the legality of any underlying agreement(s) that may exist concerning the permits or other agreement(s) between third parties, but have relied on a legal opinion of title provided by Cox & Palmer to Trevali on May 30, 2014. The title opinion is attached as Appendix A. The reliance applies solely to the legal status of the rights disclosed in Sections 3.1 and 3.2. SRK did verify the Stratmat claims were in good standing and registered under the name of Trevali Mining (Maritimes) Ltd. on the New Brunswick, Department of Natural Resources, Minerals, e-CLAIMS website:

http://nbeclaims.gnb.ca/nbeclaims/page/viewer/tenureDetails.jsf

SRK was informed by Trevali no known litigations potentially affecting the Halfmile-Stratmat integrated project exist.

3 Property Description and Location

Trevali Mining (Maritimes) Ltd. (a 100% owned subsidiary of Trevali) owns 100% interest in the Halfmile-Stratmat integrated project except certain claims in the northern portion of the Halfmile claim blocks where Trevali only has a 61.51% interest. The project is within Natural Resources Canada's National Topographic System (NTS) map, Sheet 21O/8W. It is located approximately 155 km north of Fredericton, the provincial capital of New Brunswick, and 45 km southwest of Bathurst (Figure 1).

The project is comprised of two noncontiguous claim blocks, the Halfmile and Stratmat claim blocks (Figure 1). The Halfmile claim block consists of one mineral title comprising 59 claim units and one mining lease, together covering 1,685.5 hectares (ha). The Stratmat claim block lies about 20 km southeast of the Halfmile claim block and comprises of 95 mineral claim units that cover 1,827 ha.

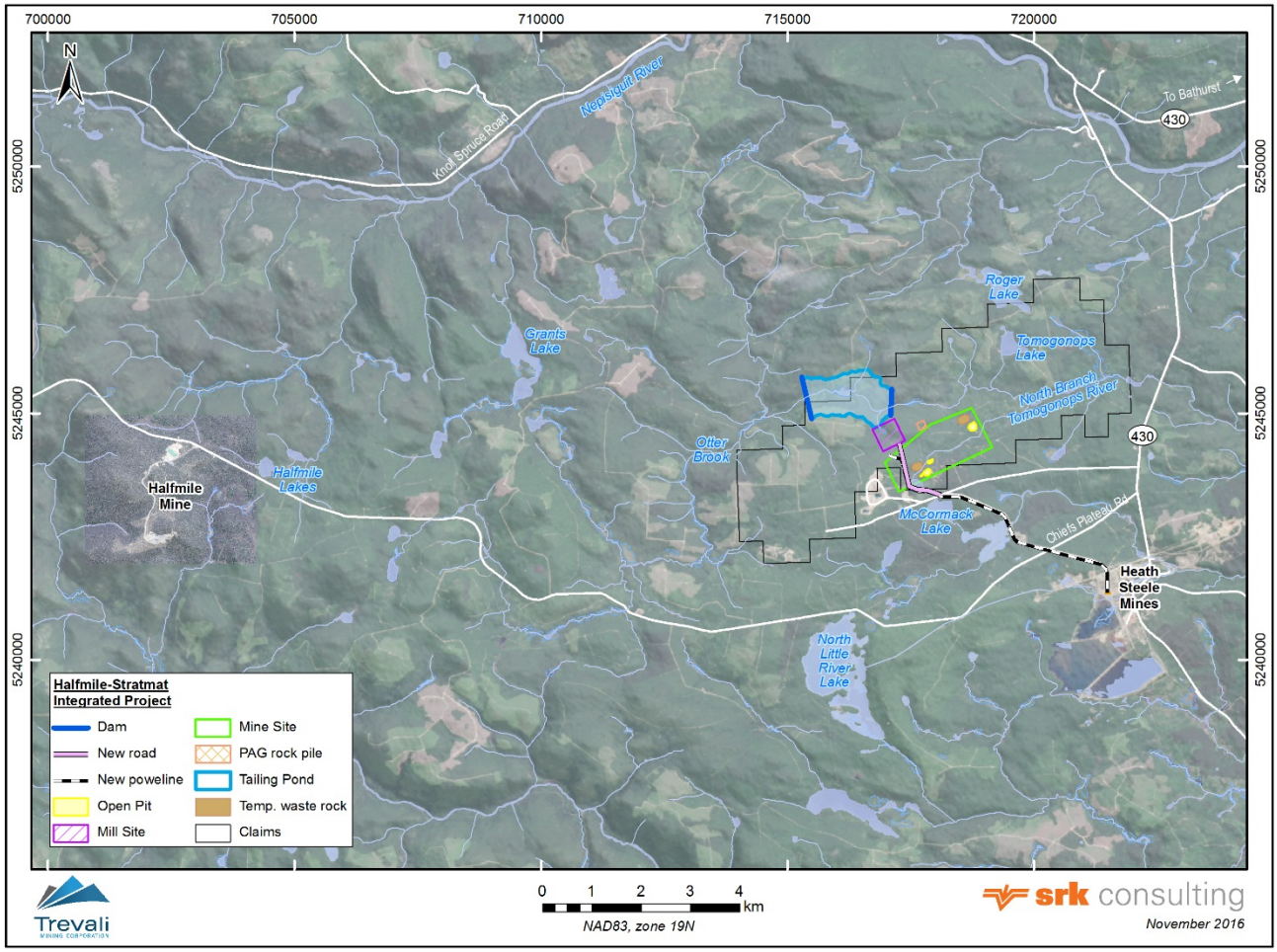


Figure 1: Halfmile-Stratmat Integrated Project Location Map

Source: SRK (2016)

3.1 Mineral Tenure

Information relating to the title and ownership of the Halfmile-Stratmat integrated project was obtained from records of the New Brunswick, Department of Natural Resources, Minerals, e-CLAIMS website (Section 2).

Mineral rights in New Brunswick are issued by means of map staking. Claim Block corner points are map located on a predefined grid. The predefined grid is set in the New Brunswick Stereographic Projection and for the purposes of this report were transposed into NAD 83, Zone 19N. There are no physical ground markers outlining the claim blocks and, for practical purposes, field locations are generally made by use of a GPS and flagging tape.

The claims on the Halfmile-Stratmat integrated project pre-date the map staking system implemented by the Province of New Brunswick in 2010. Thus, the claims for Halfmile and Stratmat claim blocks were physically staked on the ground and boundaries were marked by blazing trees and claim posts were erected at claim boundaries.

The Halfmile claims consist of a mineral claim comprising of 59 units surrounding mining lease enclosing 18 units (Figure 2). The Stratmat claims consist of a single mineral claim comprising 95 claim units (Figure 3).

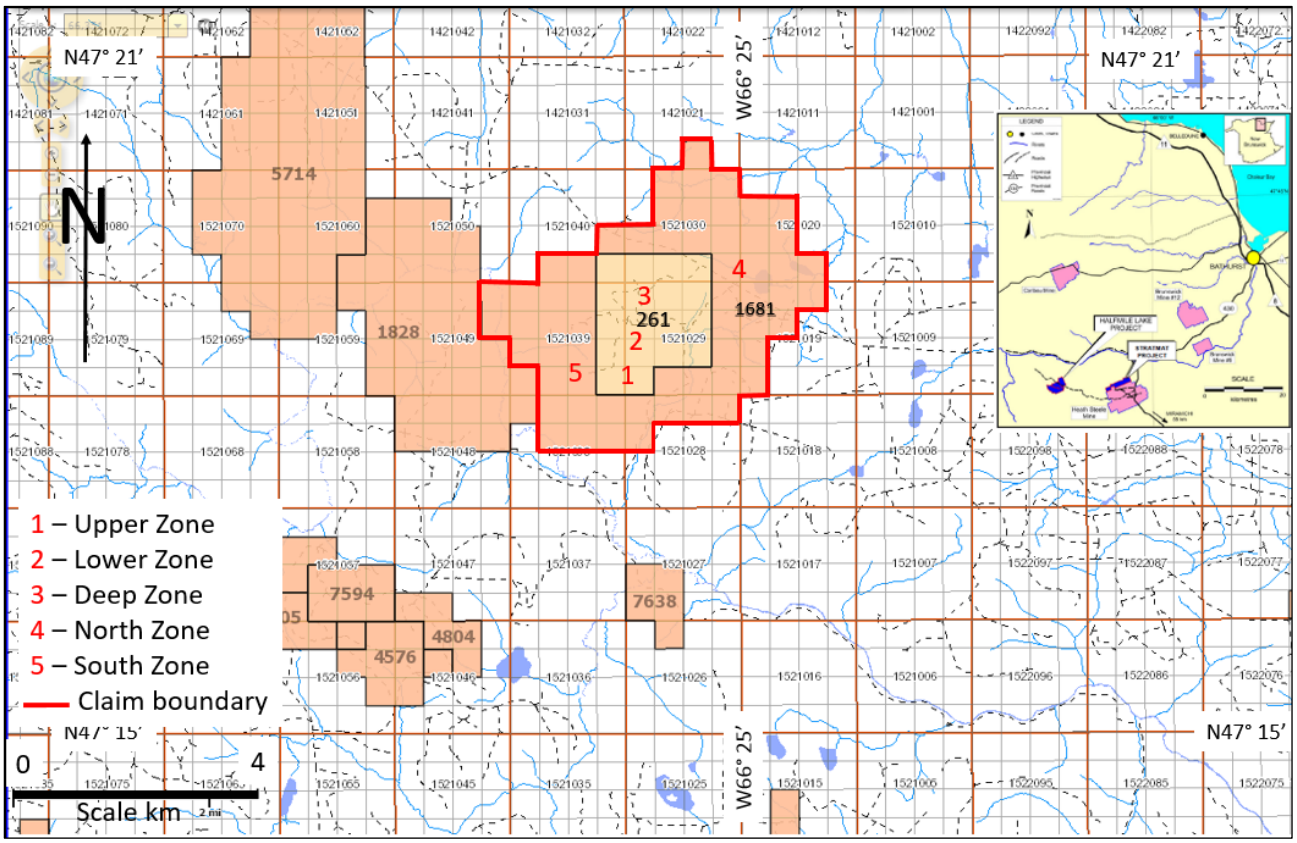


Figure 2: Land Tenure Map, Halfmile Lake Claims

Source: New Brunswick e-Claim website

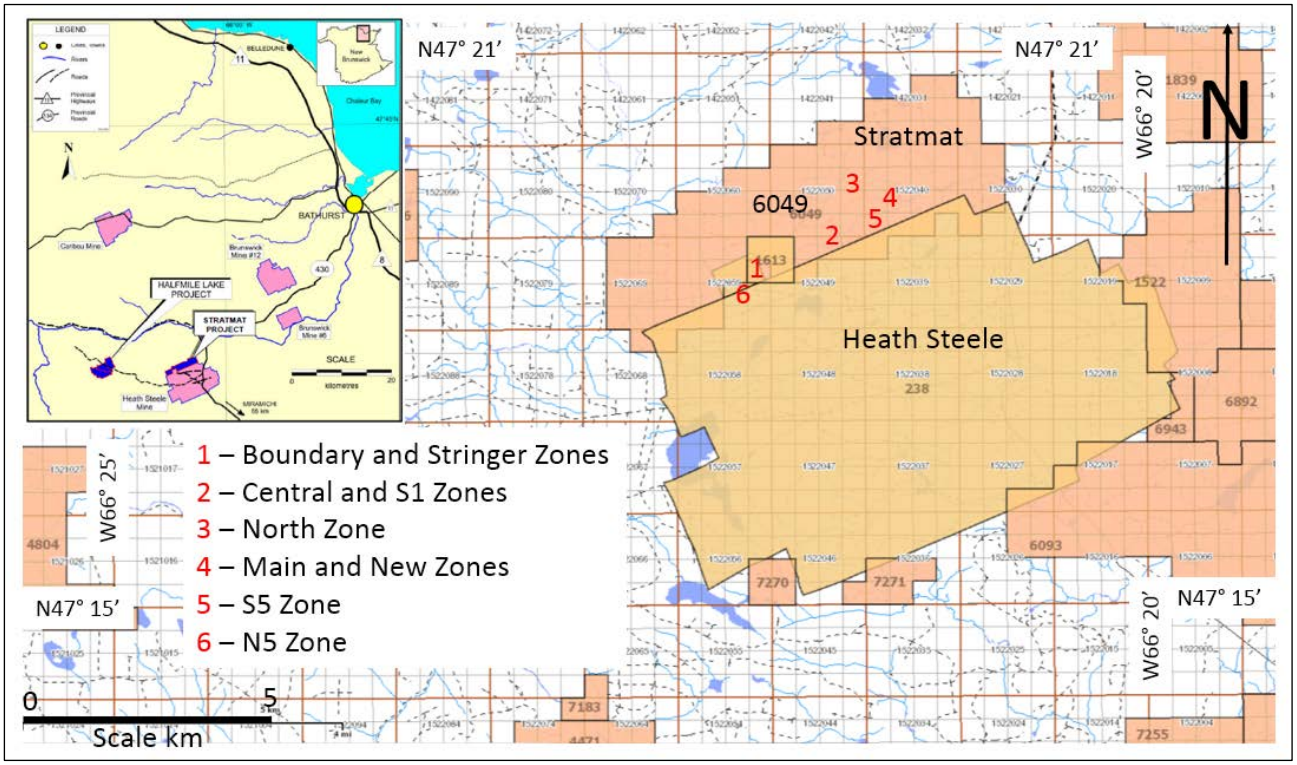


Figure 3: Land Tenure Map, Stratmat Claim Number is 6049

Source: New Brunswick e-Claim website

Each claim unit is approximately 22 ha in size yielding a total of 3,765 ha (Table 2 and Table 3). However, because some of the Stratmat units overlap with the Heath Steele mining lease to the south, the effective area of the project is only 3,513 ha. All claims are held by Trevali Mining (Maritimes) Ltd.

Table 2: Units for Halfmile Lake Mineral Claim 1681 and Mining Lease 261

Unit Id	Expiry Date	Area (ha)	Unit Id	Expiry Date	Area (ha)
1421021B	11/18/2017	21.89	1521030J	11/18/2017	21.89
1521019D	11/18/2017	21.89	1521030K	11/18/2017	21.89
1521019E	11/18/2017	21.89	1521030N	11/18/2017	21.89
1521019K	11/18/2017	21.89	1521030O	11/18/2017	21.89
1521019L	11/18/2017	21.89	1521030P	11/18/2017	21.89
1521019M	11/18/2017	21.89	1521038I	11/18/2017	21.89
1521019N	11/18/2017	21.89	1521038J	11/18/2017	21.89
1521019O	11/18/2017	21.89	1521038K	11/18/2017	21.89
1521020B	11/18/2017	21.89	1521038N	11/18/2017	21.89
1521020C	11/18/2017	21.89	1521038O	11/18/2017	21.89
1521020D	11/18/2017	21.89	1521038P	11/18/2017	21.89
1521020E	11/18/2017	21.89	1521039B	11/18/2017	21.89
1521020F	11/18/2017	21.89	1521039C	11/18/2017	21.89
1521020K	11/18/2017	21.89	1521039E	11/18/2017	21.89
1521020L	11/18/2017	21.89	1521039F	11/18/2017	21.89
1521028L	11/18/2017	21.89	1521039G	11/18/2017	21.89
1521028M	11/18/2017	21.89	1521039J	11/18/2017	21.89
1521028N	11/18/2017	21.89	1521039K	11/18/2017	21.89
1521028O	11/18/2017	21.89	1521039L	11/18/2017	21.89
1521028P	11/18/2017	21.89	1521039M	11/18/2017	21.89
1521029A	11/18/2017	21.89	1521039N	11/18/2017	21.89
1521029B	11/18/2017	21.89	1521039O	11/18/2017	21.89
1521029C	11/18/2017	21.89	1521040B	11/18/2017	21.89
1521029H	11/18/2017	21.89	1521040C	11/18/2017	21.89
1521029I	11/18/2017	21.89	1521040H	11/18/2017	21.89
1521029P	11/18/2017	21.89	1521049I	11/18/2017	21.89
1521030A	11/18/2017	21.89	1521049P	11/18/2017	21.89
1521030E	11/18/2017	21.89	**Sub Total**		**1,291.51**
1521030F	11/18/2017	21.89			
1521030G	11/18/2017	21.89	**Lease 261**	**12/12/2031**	**394.02**
1521030H	11/18/2017	21.89			
1521030I	11/18/2017	21.89	**Total**		**1,685.553**

Table 3: Units for Stratmat Mineral Claim 6049

Unit Id	Expiry Date	Area (ha)	Unit Id	Expiry Date	Area (ha)	Unit Id	Expiry Date	Area (ha)
1422021D	7/27/2017	21.89	1522040L	7/27/2017	21.89	1522059K	7/27/2017	21.89
1422021E	7/27/2017	21.89	1522040M	7/27/2017	21.89	1522059L	7/27/2017	21.89
1422031A	7/27/2017	21.89	1522040N	7/27/2017	21.89	1522059M	7/27/2017	21.89
1422031B	7/27/2017	21.89	1522040O	7/27/2017	21.89	1522059N	7/27/2017	21.89
1422031C	7/27/2017	21.89	1522040P	7/27/2017	21.89	1522059O	7/27/2017	21.89
1422031D	7/27/2017	21.89	1522049K	7/27/2017	21.89	1522059P	7/27/2017	21.89
1422031E	7/27/2017	21.89	1522049L	7/27/2017	21.89	1522060A	7/27/2017	21.89
1422031F	7/27/2017	21.89	1522049M	7/27/2017	21.89	1522060B	7/27/2017	21.89
1422031G	7/27/2017	21.89	1522049N	7/27/2017	21.89	1522060C	7/27/2017	21.89
1422031H	7/27/2017	21.89	1522049O	7/27/2017	21.89	1522060D	7/27/2017	21.89
1422031I	7/27/2017	21.89	1522049P	7/27/2017	21.89	1522060E	7/27/2017	21.89
1422031J	7/27/2017	21.89	1522050A	7/27/2017	21.89	1522060F	7/27/2017	21.89
1422041A	7/27/2017	21.89	1522050B	7/27/2017	21.89	1522060G	7/27/2017	21.89
1422041B	7/27/2017	21.89	1522050C	7/27/2017	21.89	1522060H	7/27/2017	21.89
1522030D	7/27/2017	21.89	1522050D	7/27/2017	21.89	1522060I	7/27/2017	21.89
1522030E	7/27/2017	21.89	1522050E	7/27/2017	21.89	1522060J	7/27/2017	21.89
1522030F	7/27/2017	21.89	1522050F	7/27/2017	21.89	1522068O	7/27/2017	21.89
1522030K	7/27/2017	21.89	1522050G	7/27/2017	21.89	1522068P	7/27/2017	21.89
1522030L	7/27/2017	21.89	1522050H	7/27/2017	21.89	1522069A	7/27/2017	21.89
1522030M	7/27/2017	21.89	1522050I	7/27/2017	21.89	1522069B	7/27/2017	21.89
1522030N	7/27/2017	21.89	1522050J	7/27/2017	21.89	1522069C	7/27/2017	21.89
1522039M	7/27/2017	21.89	1522050K	7/27/2017	21.89	1522069F	7/27/2017	21.89
1522040B	7/27/2017	21.89	1522050L	7/27/2017	21.89	1522069G	7/27/2017	21.89
1522040C	7/27/2017	21.89	1522050M	7/27/2017	21.89	1522069H	7/27/2017	21.89
1522040D	7/27/2017	21.89	1522050N	7/27/2017	21.89	1522069I	7/27/2017	21.89
1522040E	7/27/2017	21.89	1522050O	7/27/2017	21.89	1522069J	7/27/2017	21.89
1522040F	7/27/2017	21.89	1522050P	7/27/2017	21.89	1522069K	7/27/2017	21.89
1522040G	7/27/2017	21.89	1522059C	7/27/2017	21.89	1522069N	7/27/2017	21.89
1522040H	7/27/2017	21.89	1522059D	7/27/2017	21.89	1522069O	7/27/2017	21.89
1522040I	7/27/2017	21.89	1522059E	7/27/2017	21.89	1522069P	7/27/2017	21.89
1522040J	7/27/2017	21.89	1522059F	7/27/2017	21.89	1522070A	7/27/2017	21.89
1522040K	7/27/2017	21.89	1522059J	7/27/2017	21.89	**Total**		**2,079.20**

3.2 Underlying Agreements

The Halfmile-Stratmat integrated project is 100% owned by Trevali Mining (Maritimes) Ltd. Glencore Canada Corporation (Glencore) has the first right and option to purchase all or any portion of the concentrate off-take, as well as a 2% NSR royalty. Trevali only has a 61.51% interests in certain claims in the northern portion of the Halfmile claim blocks underlying the North zone and a portion of the Stratmat claim block is subject to a 2.5% NSR royalty to Teck Resources Limited.

3.3 Permits and Authorization

Under the New Brunswick Mining Act, exploration work that is not destructive (i.e. flagging lines, geological mapping, prospecting, soil sampling and geophysical surveys) does not require a work permit. Prior to commencing work on private land, the person or company is required to notify the land owners in writing outlining the type of work that will be carried out. All lands on the Halfmile-Stratmat integrated project are designated as Crown Land.

Work permits are required before any exploration work commences on Crown or Private Lands that will involve property destruction (i.e. line cutting, trenching, drilling, etc.).

A Notice of Planned Work on Crown Lands form must be delivered to the Mining Recorder prior to any work program. The work program cannot commence until permission to proceed has been received from the Mining Recorder and, where required, a reclamation program has been approved by the Minister of Mines in writing and the Mining Recorder has received the required security.

Trevali has all necessary work permits to conduct the current drilling and geophysical exploration programs.

3.4 Environmental Considerations

Halfmile is a fully permitted developed site, while Stratmat is a green field project area.There is no evidence to indicate any pre-exisitng or non-disclosed environmental liabilities area covered by the project.

In New Brunswick, any trenching, drilling, or other work that could potentially contribute to the disturbance or contamination of a watercourse or wetlands must be performed outside of a 30-metre buffer zone from the banks of any watercourse or wetlands. Locations of areas affected and this 30-metre buffer are publicly available on the New Brunswick Government Website (www2.gnb.ca). Apart from the 30-metre disturbance restriction associated with designated watershed, no other land designations impose restrictions within the project.

The Halfmile site has been previously operated by Trevali and the proposed start-up does not represent a significant variance to previous operation. Trevali will continue to operate the property in accordance with all applicable provincial and federal regulations and permits (described in Section 19).

The proposed Stratmat Mine and milling complex project is not currently permitted and will be subject to New Brunswick EIA Regulation. The NB EIA Regulation requires that the proposed construction, operation, modification, extension, abandonment, demolition or rehabilitation of certain projects or activities, must be registered. Therefore, the proposed mine and milling operations at Stratmat will need to be registered under the NB EIA Regulation, at a minimum. While the throughputs for the proposed mine and mill at Stratmat are below the federal EA triggers, the federal Minister of Environment may still, in his/her discretion, require a federal EA to be completed if there are real or perceived concerns about significant environmental effects, or in the face of extreme public pressure. Furthermore, the depositing of deleterious substances produced by mines (e.g., tailings, waste rock) is addressed by the requirement for any new tailings impoundment in waters frequented by fish to be added to Schedule 2 of the *Metal Mining Effluent Regulations (MMER)* under the *Fisheries Act*. The specific requirements at Stratmat would require confirmation with regulatory agencies in parallel to the provincial and/or federal environmental assessments.

3.5 Mining Rights in New Brunswick

New Brunswick, as part of Canada, has an extremely low risk of terrorism, kidnapping, and civil war. It has a long established democratic system of government and its legal system is based on British common law. Mining activities are governed by the modern well-defined New Brunswick Mining Act.

Mineral rights in New Brunswick are issued by means of staking (now by form of map or internet staking). Claim Block corner points are map located on a predefined grid. The predefined grid is set in the New Brunswick Stereographic Projection and for the purposes of this report has been transposed into NAD 83, Zone 19N. There is no need to physically locate the claims with ground markers outlining the claim blocks. Field locations are normally made by use of a GPS and flagging tape.

As defined under the Mining Act, most minerals are owned by the Crown; however, some land grants reserved only specific minerals to the Crown and therefore other minerals were, in fact, transferred to the grantee. Prior to 1810, it was common for gold and silver and certain other minerals to be reserved to the Crown. The Mining Act defines a mineral as any natural, solids, inorganic or fossilized organic substances and such other substances as are prescribed by regulation to be minerals, but does not include:

- Sand, gravel, ordinary stone, clay or soil unless it is to be used for its chemical or special physical properties, or both, or where it is taken for contained minerals
- Ordinary stone used for building or construction
- Peat or peat moss
- Bituminous shale, oil shale, albertite or intimately associated substances or products derived there from
- Oil or natural gas
- Such other substances as are prescribed by regulation not to be minerals.

Crown-owned minerals are property separate from the soil; that is, a landowner owns the surface rights but does not own minerals unless some minerals were granted with the land and each conveyance since the granting has preserved the ownership of those minerals. By means of the Mining Act, the province makes Crown-owned minerals available for exploration and development. Prospectors (persons or companies who hold prospecting licenses), holders of claims and holders of mining leases have the right to prospect, explore, mine and produce those minerals, whether they are on Crown-owned or privately-owned lands. They also have the right to access to the minerals; however, they are liable for any damage they cause.

4 Accessibility, Climate, Local Resources, Infrastructure and Physiography

4.1 Accessibility

The Halfmile-Stratmat integrated project is situated in the Bathurst Mining Camp, 60 km southwest from the city of Bathurst, the primary commercial and logistics hub for northeastern New Brunswick. It is easily accessible south from Bathurst, or north from Miramichi, on Highway 430. Further access to the project is gained via numerous logging roads that branch off Highway 430. There are two regular flights to Bathurst from Montreal and several daily flights to Moncton and to Fredericton from several major cities in Canada.

4.2 Local Resources and Infrastructure

Infrastructure in the project area is excellent. The city of Bathurst has a population of 12,275 as of 2011 and is one of the commercial and service centers for the 220,000 people who live within a two-hour drive of the city. The area, historically, has had four main industries: mining, forestry, commercial fishing and tourism. The immediate area of Bathurst has a good supply of skilled people with experience in the mining industry, many of whom have become available due to the recent closure of the Glencore Brunswick No. 12 Mine in mid-2013.

The Bathurst region hosts all of the necessary infrastructure to support mining operations as it has been home to large scale mining since the early sixties. There is a deep-water, year-round port of Belledune located in Chaleur Bay on the Atlantic Seaboard, 30 km north of Bathurst, giving business access to major international shipping lanes. The Bathurst Regional Airport, 6 km west of Bathurst, is serviced by Air Canada and local carriers. Ground transportation links consist of a rail service connected to the North American grid including a siding to the Belledune port and a network of highways with direct access to all major cities in eastern Canada and northeastern United States.

There is sufficient water supply in the project area to support mining operations. In 1993, New Brunswick Power opened its $1 billion Thermal Generating Station situated in Belledune next to Glencore's lead smelter. This facility supplies the residential and industrial power needs in the region and would be capable of supplying sufficient power to any new mining operation with a capacity of 458 megawatts (MW).

At the Halfmile site, major infrastructure was established during 2011−2012 trial mining. Thiscan support re-opening of the mine and immediately start mine production at the Upper Zone with very limited rehabilitation requirements. Major existing infrastructure includes:

- Mine portal
- Ramp down to 150 m vertical depth and two ready to start production mining fronts/levels
- Ventilation raise, underground dewatering system and other underground mine services system
- Lined surface material pads
- Modern water treatment plant and associated polishing ponds
- Core shack
- Temporary powerline and diesel generator sets
- Mine offices, etc.

4.3 Climate

The climate is typical of northern New Brunswick. The mean annual precipitation in the project area is approximately 1,060 mm. Average winter snowfall for October to May is approximately 300 centimetres (cm). Field work can be carried out year-round with very few exceptions due to snow storms in winter; however, mining operations can be carried out year-round. The annual mean temperature at the site is 3.1°C with the coldest mean daily temperature of -12.1°C in January and the warmest mean daily temperature of 18.1°C in July. Temperatures range from highs of around 25° C in July to lows in the neighborhood of -16°C in February (Table 4). Extremes of +40°C in July and -40°C in January have been known to occur.

Table 4: Yearly Range in Temperature for Bathurst, New Brunswick

Month	High °C	Low °C	Average °C
Jan	-5.8	-16.8	-11.3
Feb	-4.4	-16.3	-10.4
Mar	1.4	-8.4	-3.5
Apr	7.8	-1.8	3
May	15.6	3.9	9.7
Jun	23	9.8	16.4
Jul	24.7	13.2	19
Aug	24.3	12.3	18.3
Sep	19.2	7.7	13.5
Oct	11.2	1.6	6.4
Nov	4.1	-3.8	0.2
Dec	-1.7	-10.4	-6

4.4 Physiography

The area is situated on a gently rolling plateau with the highest elevations at 450 m along a north-south trending ridge in the central part of the project area. Drainage is predominantly to the southwest with sharp relief into the headwaters of the Northwest Miramichi River flowing along the west boundary of the property at an elevation of 350 m. The project is drained by a system of small brooks which empty into the Nepisiguit River 6 km to the northeast. The area is dominantly covered by a thin layer of glacial till (less than 2 m thick) with abundant fresh to weathered outcrop.

Vegetation throughout the project area consists mainly of spruce and balsam fir boreal forest. Almost all of the area has been clear-cut in the past and areas have been replanted.

5 History

5.1 Halfmile Project Claim Ownership

The southern part of the Halfmile area was originally staked in 1954 by Middle River Mining Company, a subsidiary of Texas Gulf Sulphur Company (Texas Gulf). In 1956 the claims were converted to Mining Lease (ML) 998. The central Halfmile area was staked by Bay Copper Mines, a subsidiary of Conwest Exploration Co. Ltd. (Conwest) in 1955 and converted to Mining Lease 1010 in 1956.

Texas Gulf optioned the Conwest Mining Lease in 1974 to acquire 100% ownership subject to a 10% net profit royalty. Billiton Exploration Canada Ltd optioned both the Texas Gulf and Conwest properties in 1979 and returned both leases to their respective owners in 1984.

The Halfmile North area was staked in 1955 by Great Sweet Grass Oils and the claims were subsequently dropped in 1960. Later in 1960, six claims were staked by Ivan Stairs to cover part of the area that was dropped and an additional nine claims were staked in 1964. The claims inadvertently lapsed in 1974 and 18 claims were subsequently staked by the McDonough Grubstake Syndicate (McDonough) with Mattagami Lake Mines as a syndicate member and operator. These claims formed Halfmile North and were later converted to ML 1281 (now Claim 1681).

In 1979, Noranda Ltd. (Noranda) acquired Mattagami Lake Mines Ltd and became operator of McDonough when work resumed on the Halfmile North block in 1987. As of January 2001, the ownership of McDonough was: Noranda - 61.51%, Vista Gold - 23.07%, Prospectors Alliance - 11.53%, and North American Rare Metals - 3.89%.

In 1985, Brunswick Mining and Smelting (BM&S) signed an agreement with Conwest to option ML 1010 (now ML261). Ownership of the Halfmile South claims became part of Kidd Creek Mines Ltd. during 1981, a subsidiary of Canada Development Corp. Also in 1985, Falconbridge Limited (Falconbridge) acquired Kidd Creek Mines Ltd. and took control of Halfmile South.

In 1988, ML 1281 was re-staked by BM&S as claims and the claim block was named Halfmile North. ML 1010 was also re-staked by BM&S as claims in 1988 and named Halfmile Central.

In 1989, Falconbridge re-staked ML 998 as a contiguous block of claims and surveyed their north boundary with the Noranda block optioned from Conwest. Noranda optioned the claim block from Falconbridge in 1992 and named it Halfmile South.

In 2005, Noranda purchased Falconbridge and subsequently changed their name to Falconbridge. In 2006, Noranda was bought out by Xstrata.

In July 2008, Kria Resources, (now a wholly-owned subsidiary of Trevali) entered into an agreement with Xstrata to purchase the Halfmile and Stratmat Properties. Under the terms of the agreement, Xstrata retained the first right to purchase all or any portion of concentrate and other mineral products producedfrom the deposits. Xstrata also retained a 2% NSR.

On April 7, 2011, Trevali Mining Corp. completed a plan of arrangement with Kria Resourcesand changed its name to “Trevali Mining Corporation”. Pursuant to the plan of arrangement, Trevali

acquired all of the issued and outstanding common shares of Kria Resources and the ownership of the Halfmile project.

5.2 Stratmat Project Claim Ownership

The area covered by the Stratmat mineral claim group and Heath Steele ML 238 has been the focus of exploration work since the staking rush of the early to mid-1950s.

The Stratmat project was originally staked by Strategic Materials Limited, that is, Stratmat Ltd., during the Heath Steele staking rush of 1954 and subsequently sold to Cominco in 1959. From 1959 to 1985, Cominco held the mineral rights to the Project area. On January 1, 1986, Noranda optioned the property from Cominco. Noranda was taken over by Xstrata in 2006 and in May of 2013, Glencore merged with Xstrata to form Glencore-Xstrata plc. Glencore has since dropped Xstrata from its name.

The Stratmat project area historically consisted of 51 contiguous mineral claims referred to as Group 61. The mineral claims were converted to MLs 1007 and 1008 sometime before 1958. These MLs were restaked and recorded on July 27, 1987 into mineral claims 327300 to 327355 inclusive around the time Noranda acquired the property. During 1989, two claims, 327314 and 327315, and portions of claims 327309, 327310, 327313 and 327316 were transferred to ML 253 to facilitate the development of the Boundary deposit. An agreement between Noranda and Cominco in 1986 allowed Noranda to earn an interest subject to 25% net proceeds of production (NPP) to Cominco.

A 1989 agreement with Noranda/ BM&S extinguished Cominco's 25% NPP in exchange for a 2.5% royalty on the property. In July 2001, Cominco and Teck merged companies to form Teck Cominco Ltd. ML 253 was excluded, for which Noranda paid Cominco cash to buy out the royalty. Noranda negotiated an option agreement including the Property claim block 1613 with SLAM Exploration Ltd. covering the period November, 2003 to 2006. In 2005, Noranda changed their name to Falconbridge Ltd. and, in 2006, was subsequently acquired by Xstrata. This agreement was terminated in 2008.

In 2008, Kria Resources entered into an agreement with Xstrata Canada Corporation -- Xstrata Zinc Canada Division (now Glencore Canada) whereby Kria Resources had the right to gain 100% ownership of the Halfmile and Stratmat projects by paying US$18 million (completed) and issuing units worth a total of CAD$7 million (completed).

Glencore retained a first right and option to purchase all or any portion of the concentrate off-take, as well as a 2% NSR royalty. In 2010, the Stratmat project was transferred from Kria Resources to Trevali Mining (Maritimes) Ltd, a wholly-owned subsidiary of Trevali Mining Corporation.

5.3 Halfmile Project Exploration Activity

The Halfmile portion of the project has been heavily explored by Xstrata and its predecessors, since the 1950s. The area was again extensively explored during the 1980s and 1990s when the Heath Steele Mine was in production.

On January 6, 2012, Trevali initiated preliminary mineral production from the uppermost portions of the Halfmile project with toll-processing at Xstrata's Brunswick-12 mill. Four separate campaigns ore were processed through the Brunswick 12 plant to assess the response of the Halfmile ore. A total of nominal 114,000 tonnes of ore were processed during the four campaigns, with nominal throughput of 5,000 t/d being processed. Trevali ceased test-mining at the Halfmile project in mid-

2012 in order to preserve the deposit and focus efforts on future contemplated stand-alone mining and milling operations.

On November 25, 2013, Trevali carried out geotechnical and resource definition drilling; environmental baseline studies, tailings basin study and archeological impact assessment all conducted by Stantec Consulting.

Table 5 summarizes the exploration activity for the Halfmile portion of the project. For a more detailed description, please refer to individual property assessment reports available on the Government of New Brunswick, Department of Natural Resources website (Websites: Assessment Reports).

Table 5: Summary of Historical Exploration Activity for the Halfmile Claims

Year	Assessment File	Company	Work Performed
1954		Texas Gulf	Claim staking after regional geological work indicated a favourable environment for mineralization
1955-56	471562	Conwest	EM Survey and 31 DDH
1955-56	471618	Texas Gulf	EM and soil surveys, 93 DDH
1956	472118	Texas Gulf	EM, Mag, resistivity and gravity surveys
1959	471668	Texas Gulf	Mag and IP surveys
1960	470541	Bay Copper Mines	One DDH
1961	471542	Bay Copper Mines	Mapping
1962	471620	Texas Gulf	5 DDH and metallurgical testing
1966		Texas Gulf	8 DDH
1967	471669	Texas Gulf	8 DDH
1969	471595	Bay Copper Mines	One DDH mag survey
1971	471595	Keevil mining	Mag and SP survey
1974	471665	Texas Gulf	18 metallurgical boreholes
1975	471666	Texas Gulf	8 DDH and additional EM survey
1976	471664	Texas Gulf/Mattagami Lake	3 DDH Mag, VLF and HLEM surveys
1977	472158	Texas Gulf/Mattagami Lake	9 DDH
1979		Billiton Canada	30 DDH and resource estimation
1980		Billiton Canada	2 DDH
1983		Billiton Canada	Metallurgical testing
1985	473241	Billiton Canada	Gravity survey
1986	473318	Noranda	Gravity and collar survey
1987	473798	Noranda	10 DDH
1988		Noranda	8 DDH
1991	474014	Falconbridge	Ground geophysical surveys and 1 DDH
1992		Noranda	HLEM, Mag and VLF Survey
1993		Noranda	13 DDH and Gravity survey
1994		Noranda	15 DDH
1995		Noranda	Feasibility study
1996		Noranda	2D seismic survey
1997		Noranda	2 DDH
1998		Noranda	Resource estimation
2000		Noranda	4 DDH
2010		Kria Resources	4 DDH
2011		Kria Resources	15 DDH
2012		Trevali	24 DDH, UG development and test mining
2013		Trevali	15 DDH

5.4 Stratmat Project Exploration Activity

The Stratmat portion of the project has been heavily explored by Xstrata and its predecessors since the 1960s. The area was again extensively explored during the 1980s and 1990s when the Heath Steele and Stratmat mines were in production.

In 1988, Noranda developed an exploration decline into the Boundary deposit and collected a 3,000 tonne bulk sample that was used to prepare a feasibility study for the Boundary deposit.

The following is a summary of work completed on the Stratmat portion of the project (Table 6). For a more detailed description, please refer to individual property assessment reports available on the Government of New Brunswick, Department of Natural Resources website (Websites: Assessment Reports).

Table 6: Summary of Historical Exploration Activity for the Stratmat Claims

Year	Assessment File	Property	Company	Work Performed
1957	471509	Stratmat	Cominco	Geology, ground Electromagnetic (EM) and Magnetic (Mag) geophysical surveys, 36 diamond drill holes (DDH)
1962	470989	ML 1007-8	Cominco	18 DDH
1963	472386	ML 1007-8	Cominco	7 DDH
1964	470991	ML 1007	Cominco	2 DDH
1964	471574	ML 1007	Cominco	Geology and soil geochemistry
1966	471515	Stratmat GP 61	Cominco	5 DDH
1971	470999	ML 1008	Cominco	Gravity survey
1975	471355	ML 1008	Cominco	15 DDH
1981	472679	ML 1007-8	Cominco	Geological survey, 10 diamond drill logs
1986	473286	Stratmat Group	Noranda	Three trenches, assays
1987	473385	Stratmat Group	Noranda	Very Low Frequency (VLF), Horizontal Loop EM (HLEM), gravity, and geochemical surveys, 98 drill logs, ore reserve calculations
1988	473544	Stratmat Group	Noranda	VLF, HLEM, Geochemical surveys, 76 drill logs, decline and bulk sample, ore reserve estimations
1989	473748	Stratmat Group	Noranda	University of Toronto EM (UTEM 3) survey, elevation, contour, till geochemistry, Pionjar overburden survey, 37 drill logs, mise à la masse/Self-Potential (SP) survey, borehole Pulse EM survey
1990	474129	Stratmat Group	Noranda	Stratmat Group; downhole EM, mise à la masse and gravity surveys, Pionjar overburden survey, 53 diamond drill holes, reserve calculations, petrographic analyses
1990-1991	474408	Stratmat Group	Noranda	30 drill holes, whole rock geochemistry
1996-1997	Internal			5 holes drilled totaling 1347.9 m
2004		Stratmat	Noranda	54 line km of Mega TEM II Airborne Geophysical survey
2011	477141	Stratmat	Kria Resources	NI 43-101 report

5.5 Halfmile Project Historical Mineral Resource Estimates

A historical mineral resource estimate was prepared by Noranda as part of a feasibility study that was completed in 1998 (Table 7). This mineral resource estimate is historical, and was prepared before the implementation of the CIM Standards for Reporting Mineral Resources and Mineral Reserves. This estimate does not all follow the categories as defined under NI 43-101 and should not be relied upon. SRK could not verify the historical resource estimates and Trevali is not treating these estimates as current resources. The historical estimate should not be relied upon as they are being superseded by the resource estimate presented in Section 13 of this report.

In 2011, Wardrop (now Tetra Tech) estimated the mineral resource for the Halfmile project (Table 8). The mineral resource estimate followed the guidelines outlined in NI 43-101 and was estimated using inverse distance square interpolation method with GEOVIA GEMS 3-D block modelling software. SRK has not reviewed the Wardrop estimate and while it is relevant in that it provides an estimate of the mineral resources contained on the project before the recent drilling, the mineral resource estimate is no longer considered current as it is being replaced by the estimate presented in Section 13 of this report.

Table 7: Halfmile Historical Mineral Resource Estimates

Zone	Tonnes ('000)	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)
North	n/a	n/a	n/a	n/a	n/a
Upper	1,008	2.54	7.59	0.44	48.27
Lower	7,510	2.83	8.94	0.1	38.8
Deep	n/a	n/a	n/a	n/a	n/a
Total	**8,518**	**2.8**	**8.78**	**0.14**	**39.92**

Table 8: Tetra Tech 2011 Halfmile Mineral Resource Estimation at 5% Zinc Equivalent Cut-off

Class	Zone	Tonnes ('000)	Zn (%)	Pb (%)	Cu (%)	Ag (g/t)
Indicated	Upper	1,193	7.96	2.31	0.43	16.95
Indicated	Lower	4,472	9.65	2.81	0.12	37.94
Indicated	Deep	0	0	0	0	0
Indicated	North	597	7.56	1.4	0.49	4.84
Indicated	**Total**	**6,262**	**8.13**	**2.58**	**0.22**	**30.78**
Inferred	Upper	156	8.08	2.64	0.17	6.19
Inferred	Lower	1,071	9.1	2.76	0.08	38.55
Inferred	Deep	4,826	6.86	1.6	0.15	17.04
Inferred	North	25	7.46	1.55	0.73	6.19
Inferred	**Total**	**6,078**	**6.69**	**1.83**	**0.14**	**20.51**

5.6 Stratmat Project Historical Mineral Resource Estimates

A historical mineral resource estimate (Table 9) was prepared in 1998 by Noranda, later taken over by Xstrata. These mineral resource estimates are historical, and were prepared before the implementation of the CIM Standards for Reporting Mineral Resources and Mineral Reserves. These estimates do not all follow the categories as defined under NI 43-101 and should not be relied upon. SRK could not verified the historical mineral resource estimates and Trevali is not treating these estimates as current resources. The historical estimate should not be relied upon as they are being

superseded by the mineral resource estimate presented in Section 13 of this report and should not be relied upon.

Table 9: Stratmat Historical Mineral Resource Estimates

Zone	Tonnes ('000)	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)
Central Zones	713	4.21%	8.45%	0.84%	58.78	0.26
Main Zone Cu	152	0.07%	0.43%	3.21%	18.76	0.00
Main Zone Pb/Zn	726	3.08%	7.35%	0.32%	79.90	0.00
S1 Probable	1,505	3.15%	7.91%	0.32%	75.36	0.89
S1 Probable	1,147	3.22%	7.58%	0.50%	50.43	0.64
Totals	**4,243**	**3.22%**	**7.55%**	**0.56%**	**64.58**	**0.53**

Source: Dupras and Sandison (not dated)

In 2009, Wardrop (now Tetra Tech) estimated the mineral resource for the Stratmat project (Table 10). The mineral resource estimate followed the guidelines outlined in NI 43-101 and were estimated using inverse distance square interpolation method with MineSight 3D block modelling software. SRK has not reviewed the Wardrop estimate and while it is relevant in that it provides an estimate of the Inferred mineral resources contained on the project before the recent drilling. However, the Wardrop is superseded by the estimate presented in Section 13 of this report and should not be relied upon.

Table 10: Stratmat Inferred Mineral Resources as Estimated by Wardrop in 2009

ZnEQ Cut-Off	Zone	Tonnes ('000)	Zn EQ (%)	Zn (%)	Pb (%)	Cu (%)	Ag (g/t)	Au (g/t)
	10	267	7.07	5.20	2.17	0.32	60.59	0.63
	15	216	6.65	5.03	2.67	0.36	28.06	0.09
	20	1,474	8.41	6.33	2.53	0.34	62.57	0.83
	21	106	7.44	5.98	2.86	0.07	44.71	0.33
	22	139	8.17	5.99	2.77	0.26	60.67	0.93
5%	25	676	6.92	5.20	2.49	0.36	40.40	0.28
	30	157	7.61	6.22	2.16	0.21	45.91	0.47
	40	837	9.58	7.13	3.14	0.41	64.49	0.85
	45	88	10.25	7.45	4.07	0.74	44.53	0.15
	50	738	8.65	6.48	2.68	0.60	39.55	0.49
	51	826	7.55	5.56	2.13	0.45	60.76	0.63
Totals		**5,525**	**8.16**	**6.11**	**2.59**	**0.40**	**54.21**	**0.62**

5.7 Historical Production

There has been limited production from the Halfmile project. In 2012, Trevali initiated an underground mining program with purpose to test mine the Upper zone at Halfmile. A total of 114,000 tonnes of ore were mined and processed at the BM&S mill at Brunswick No 12 mine during four campaigns.

There has been no production from the Stratmat project but in 1989, following the completion of a feasibility study, Noranda mined the Boundary and N5 deposits, which are essentially the strike extensions of the Central and Main zones at the Stratmat project (Figure 3). At the end of 1993 when mining ceased, the Boundary deposit had produced 1.1 million tons grading 2.98 % lead, 8.11% zinc, 0.35% copper and 44 grams per tonne (g/t) of silver (Hamilton and Park 1993).

6 Geological Setting and Mineralization

6.1 Regional Geology

The Bathurst Mining Camp (BMC) occupies a roughly circular area of approximately 70 km diameter in the Miramichi Highlands of northern New Brunswick. The area boasts some 46 mineral deposits with defined tonnage and another hundred mineral occurrences, all hosted by Cambro-Ordovician rocks that were deposited in an ensialic back-arc basin (Figure 4).

The rocks in the BMC are divided into 5 groups: Miramichi, Tetagouche, California Lake, Sheephouse Brook, and Fournier groups that are largely in tectonic contact with one another (van Staal et al. 2003). The Cambro-Ordovician Miramichi group represents a passive margin sequence that was deposited on the Avalonian platform. This passive margin became an active, Andean-type margin in the middle to late Arenig with the subduction of oceanic crust beneath the margin and the development of the ensialic Popelogan volcanic arc (van Staal et al. 2003).

The Middle Ordovician California Lake, Tetagouche, and Sheephouse Brook groups represent the initial stages of back-arc rifting of ensialic crust. Radiometric dating shows that the California Lake, Tetagouche, and Sheephouse Brook groups are approximately coeval and there are similarities in the internal stratigraphy of each group (van Staal et al. 2003). The lower part of each group is dominated by felsic volcanic rocks and the upper part by mafic volcanic rocks, which are overlain by carbonaceous shale and pelagic chert. This bimodal suite of rhyolites, basalts, cogenetic granites and gabbros formed by partial melting of lower crustal rocks and the mantle, during progressive back-arc rifting of the Avalonian basement (van Staal, Winchester, and Fyffe 1991). The basalts are both tholeiitic and alkalic and show a progression from enriched, fractionated continental tholeiites to alkali basalts to more primitive, mantle-derived midocean ridge, tholeiitic pillow basalts (van Staal et al. 1991). Most massive sulfide deposits of the BMC are associated with the respective felsic volcanic rocks in each group.

The accretion of the Popelogan arc to the Laurentian margin in the Caradoc was followed by the closure of the back-arc basin by northwest-directed subduction beneath both the arc and Laurentia. All groups of the BMC were intensely deformed and tectonically assembled in the Brunswick subduction complex (van Staal 1994).

Rocks of the BMC have been subjected to complex polyphase deformation and associated greenschist and blueschist metamorphism (Helmstaedt 1973; van Staal et al. 1990). Five episodes of folding have been recognized in the Camp, but only the first two folding events account for the majority of the complex structural geometry of the Camp (van Staal and Williams 1984).

The earliest deformation event (D1) is characterized by strong layering-parallel foliation (S1), asymmetrical intrafolial folds (F1), and a well-defined stretching lineation (L1). The D1 structures are concentrated in zones of high strain, are commonly associated with stratigraphic repetition, and are interpreted to have resulted from progressive deformation during imbrication in the northwest-dipping Brunswick subduction zone (van Staal 1994). The first phase of deformation has been interpreted by van Staal et al. (1992) to have taken place in the Late Ordovician to Early Silurian.

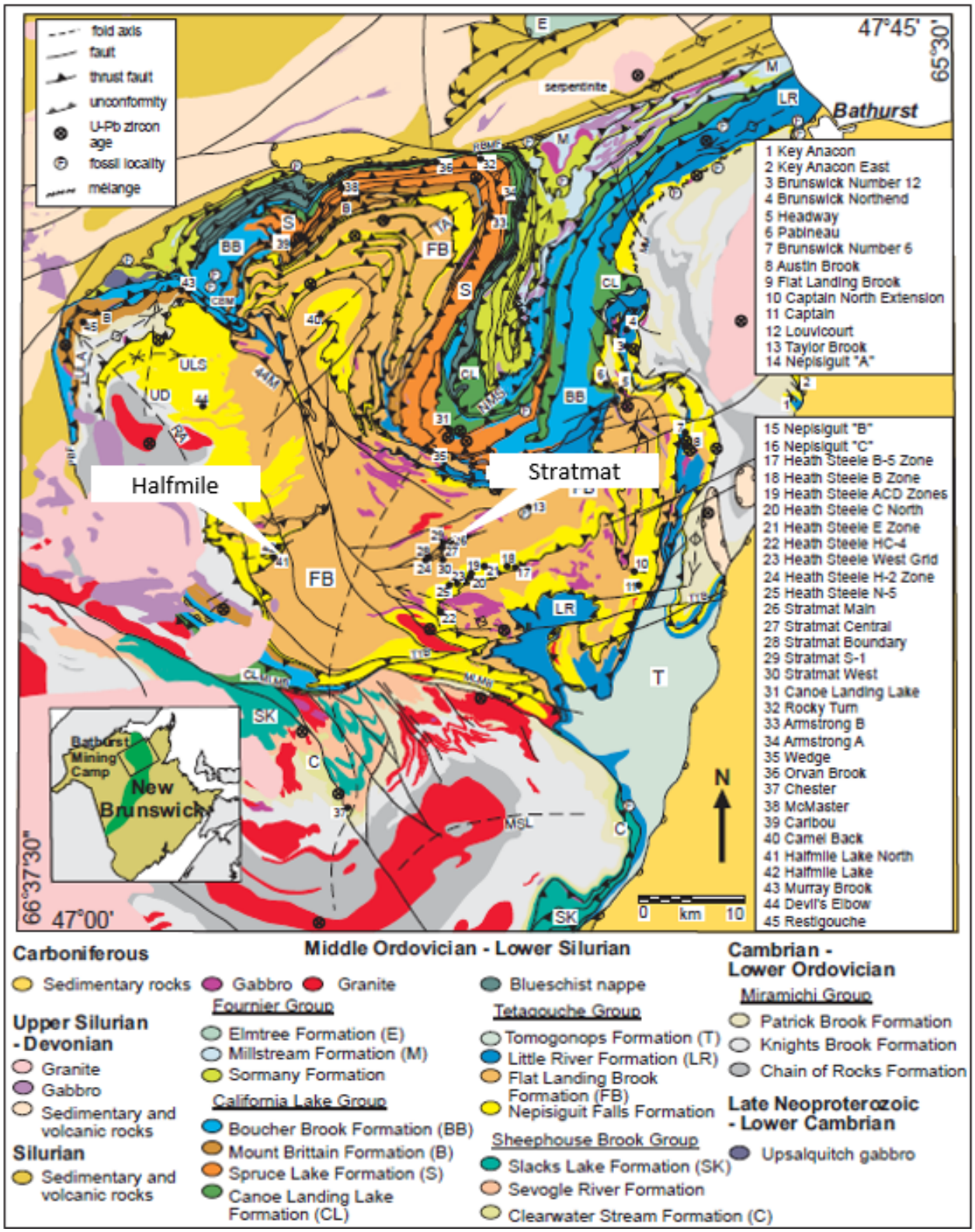


Figure 4: Regional Geological Setting

Source: Goodfellow (2007), with modifications

The second deformational event (D2) is represented by tight, near-vertical isoclinal folds that are probably Early Silurian or older (McCutcheon et al 1993) and occurred during continental collision. The plunges of the F2 folds are generally shallow except near F1 fold closures. The cleavage associated with F2 folds is well developed, steeply dipping, and sub parallel to S1 along the limbs of F2 folds. This deformation event is partly associated with the obduction of the accretionary wedge onto the basin margin.

Structures associated with D1 and D2 have been refolded by open to tight recumbent F3 folds (van Staal and Fyffe 1991). The S1 and S2 fabrics were reoriented to shallow-dipping attitudes where D3 was intense. Earlier structures have been refolded by large- and small-scale F4 and F5 folds, although the overprinting relationships are rarely preserved. Examples of later folds include the Nine Mile synform and the Tetagouche antiform (van Staal and Williams 1984). These F4 and F5 structures probably correspond to kink and parasitic folds documented by Davis (1972) in the area of the Caribou Mine.

6.2 Halfmile Project Local Geology

The Halfmile project is underlain predominantly felsic volcanic rocks and lesser sedimentary rocks which are host to all massive sulphide deposits on the property (Figure 5). Provincial Government regional mapping projects have classified the rocks as belonging to the Flat Landing Brook formation of the Middle Ordovician Tetagouche group and Nepisiguit Falls formation.

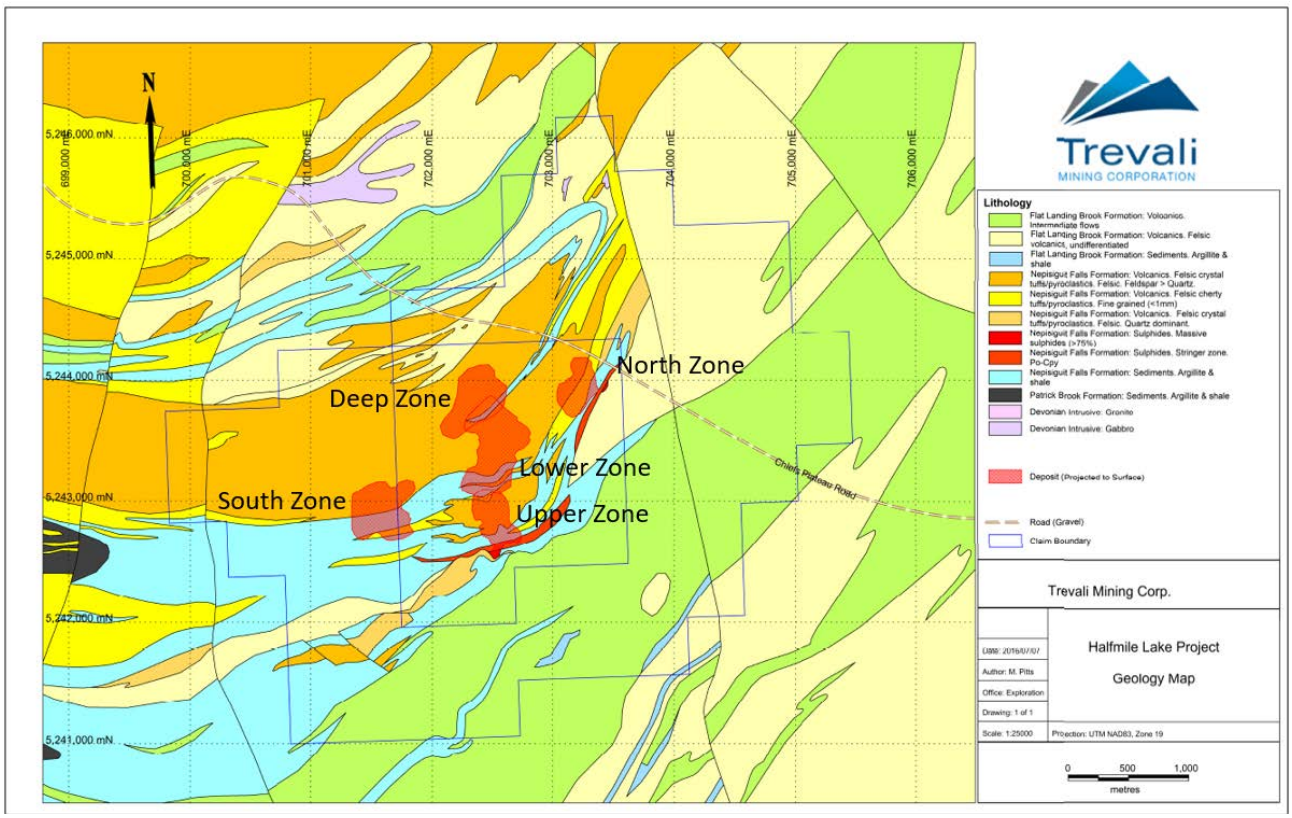


Figure 5: Local Geological Setting for Halfmile Project

Source: Trevali (2016)

At Halfmile, the Flat Landing Brook formation consist mainly of rhyolite flows, quartz feldspar porphyry and mafic volcanic rocks. The Nepisiguit Falls formation includes the massive sulphide mineralization, quartz feldspar porphyry and clastic sedimentary rocks.

The stratigraphy for Halfmile is overturned. A stockwork of pyrrhotite-chalcopyrite mineralization occurs on top of the massive sulphides. Well-developed S1 foliation/cleavage is easily observed in most drill core samples. In general, the enveloping surface for this cleavage is oriented northeast with a dip of 40 to 60° to the northwest. An S2 crenulation cleavage accompanied by small parasitic kink folds is oriented at a high angle to the S1 foliation in the nose of folds.

Detailed interpretations are difficult to assess due to poor documentation in old holes and difficulty in assessing structure from drill data. Faulting is poorly documented in pre-1970 drilling. However, later interpretation suggests the influence that faults have on the sulphide horizon. A single thrust fault is readily observed immediately above or within the sulphide horizon. This fault occurs in about the same stratigraphic position on all of the Halfmile project. Local small-scale sheath folds may increase the thickness and grade within the hinge of the Lower Zone. Figure 6 is a schematic diagram showing the structural complexity near the sulphide deposits.

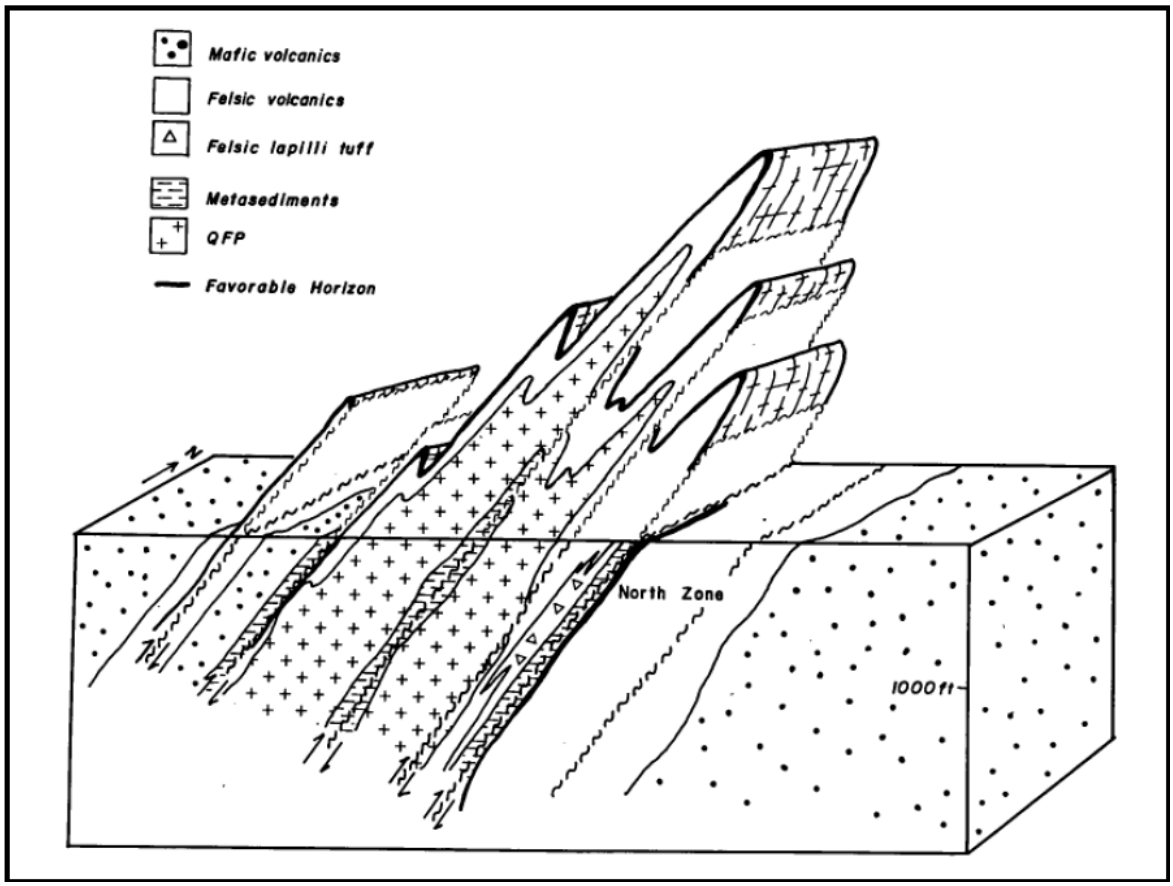


Figure 6: Schematic Structural Model of Halfmile Projects

Source: Tetra Tech (2011)

6.3 Stratmat Project Local Geology

The Stratmat claims are underlain by a magnetic northeast-southwest trending sequence of predominantly felsic volcanic rocks and lesser sedimentary rocks which are host to all massive sulphide deposits on the property (Figure 7). Provincial Government regional mapping projects have classified the rocks as belonging to the Flat Landing Brook formation of the Middle Ordovician Tetagouche group, which places the deposits stratigraphically above the Nepisiguit Falls formation hosted Heath Steele Minedeposits (Wilson, 1993) located 3 to 5 km to the south. Regional metamorphism is lower greenschist facies.

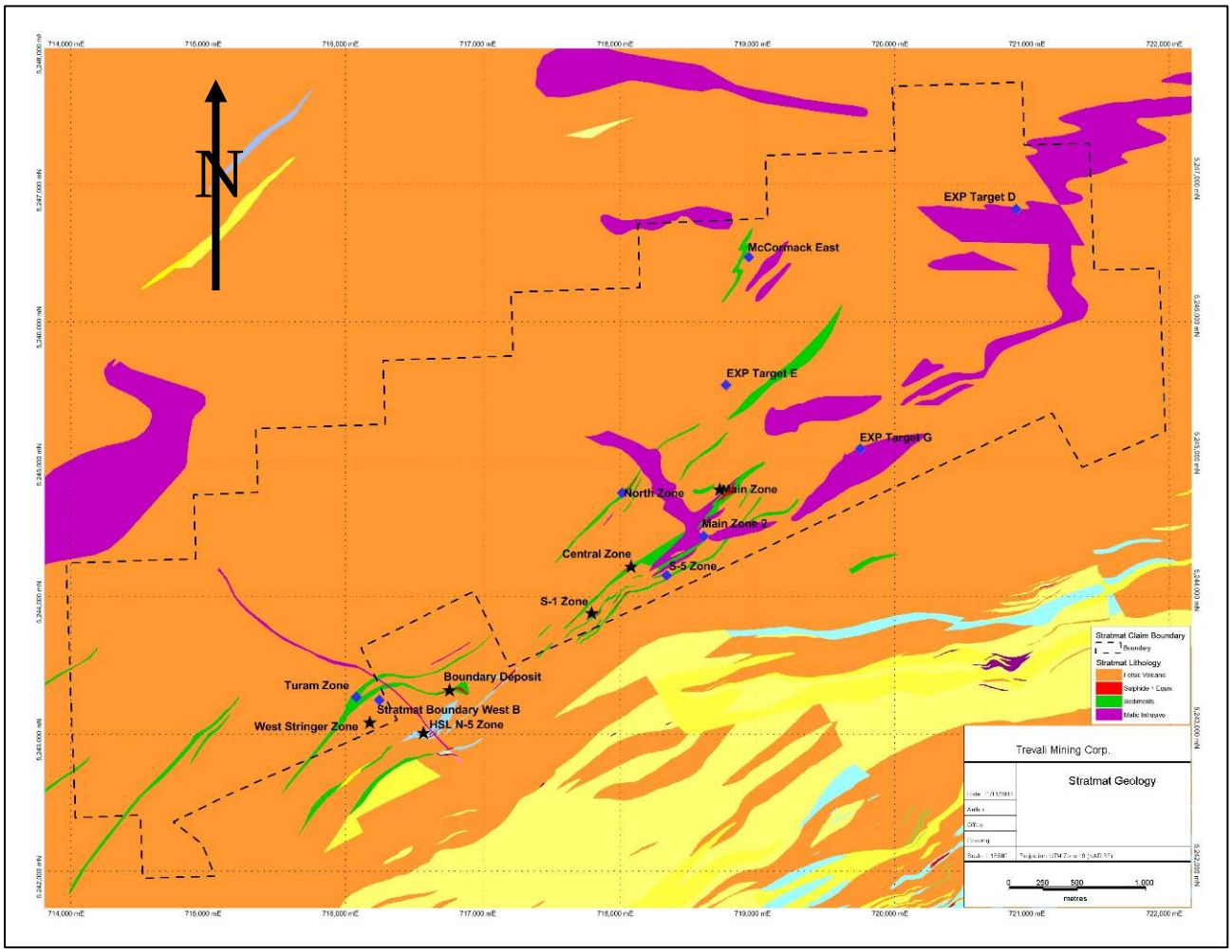


Figure 7: Local Geology Setting for Stratmat Project

Source: Trevali (2016)

Coeval foliated gabbro intrusive rocks are common in the eastern half of the property and crosscut and locally assimilate portions of the favourable stratigraphy including parts of the Main Zone. Narrow, magnetic to non-magnetic discordant diabase dykes intrude western portions of the project area, with many aligned parallel to or along east- southeast-trending fault structures. A red to green unfoliated Silurian syenite dyke trends east-southeast, west of the Boundary deposit and cuts stratigraphy at least as far south as the Heath Steele ACD zones. The syenite dyke also displays a magnetic signature. A quartz-feldspar porphyry dyke, reminiscent in many respects of Heath Steele

hangingwall (HW) rocks, was intersected in one hole northwest of the Boundary depositt. Distinctive intrusive rock types now number four.

Structurally, the property is highly complex with five periods of deformation being documented in the area (McBride 1976; de Roo et al. 1990; Park 1996). Tectonic thickening and repetition of the mineralized horizon has both enhanced grades and produced mineable widths of ore at the Boundary deposit and N-5 Zones. In cross section, property scale F2 folds manifest themselves as the Boundary antiform, S- 1/North zone synform and the synform/antiform fold repetition of the favourable horizon at depth, below the Boundary open pit. Best grades and widths of economic mineralization at the S-1 deposit tend to occur along the limbs of the major folds, adjacent to the closure areas. The detailed structural study conducted by Adrian Park on the N-5 and Boundary deposits has indicated extremely complex structure on the mine scale. Structures that exist at Boundary/N-5 no doubt persist elsewhere along the Horizon and complicate the rudimentary interpretations of borehole date.

Two consistent fault orientations have been documented. The Stratmat fault trends east-northeast, and overall movement appears to be dextral strike-slip, with a small dip slip component, down to the south (Park 1996). Parallel structures are interpreted at the S-1 deposit and along with Stratmat fault, are believed to be the earliest generation fault structures. A certain periodicity seems to be displayed by these faults.

Periodic east-southeast trending faults are the second and presumably younger orientation observed. Sinistral movement can be implied based upon ground geophysics (magnetics). Locally, these fault zones appear to be intruded by diabase and, west of the Boundary project, by syenite dykes. Although not believed to disrupt stratigraphy, evidence from drilling suggests that a major fault crossing the baseline at approximately 12300E appears to be a pivot or scissor fault because of dip changes immediately east and west of the structure.

6.4 Mineralization

The sulphide minerals consist of disseminated and massive pyrite-sphalerite-galena and chalcopyrite. The sulphide minerals are fine- to medium-grained, and are coarser than those typically found in deposits of the BMC.

Disseminated mineralization, commonly of economic grade, occurs in the phyllitic sedimentary rocks as well as in the talc layers which locally grade into massive sulphide. A layer of massive pyrite-chalcopyrite, typically less than 1 m thick, occurs locally on the stratigraphic footwall side of the economic mineralization.

Stratigraphic relationships are based on observations of drill and rock exposures. The copper-rich layer may be in contact with, or grade into pyrite-poor massive sphalerite-galena ore that locally is up to a few meters thick (grades average 5 to 15% lead and 15 to 35% zinc). Gangue minerals include muscovite, talc, chlorite, quartz, and carbonates. Many of the copper-rich and lead-zinc-rich massive sulphide layers are separated by talcose or phyllitic zones that commonly carry disseminated sulphide mineralization. Calcite is the most common carbonate, but ferroan dolomite and siderite also are present.

7 Deposit Types

The Halfmile and Stratmat projectss are volcanic massive sulphide (VMS) deposits typical of the BMC. The BMC hosts 45 volcanic-sediment hosted massive sulphide deposits and 95 occurrences, including the world-class Brunswick 12 Mine. BMC deposits formed in a sediment-covered back-arc continental rift during periods when the basin was stratified with a lower anoxic water-column (Figure 8). The basin was subsequently intensely deformed and metamorphosed during multiple collisional events related to east-dipping subduction of the basin.

The VMS deposits typically form lenses of polymetallic massive sulphide. Most deposits are zoned vertically and laterally from a high-temperature, vent-proximal, copper-polonium-bismuth-rich veined and brecciated core to vent-distal zinc-lead-silver-rich hydrothermal sediments. The vent complex is commonly underlain by a highly deformed sulphide stringer zone that extends hundreds of metres beneath deposits and consists of veins and impregnations of sulphides, silicates, and carbonates that cut chloritized and sericitized volcanic and sedimentary rocks.

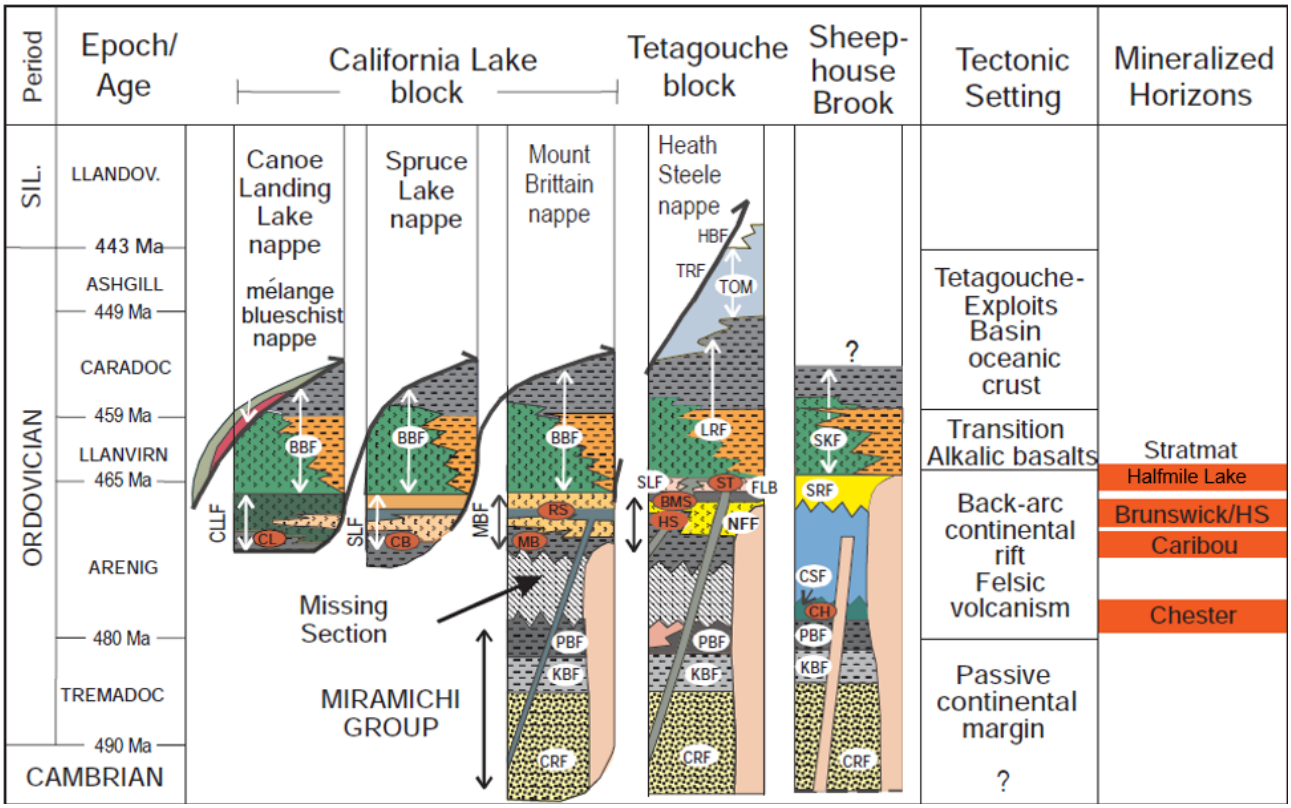


Figure 8: Stratigraphic Location of Halfmile and Stratmat Projects

Source: Goodfellow (2007)

8 Exploration

Historically, exploration has been carried out separately over the Halfmile and Stratmat projects.

8.1 Halfmile Project

In 2012, Trevali undertook trail mining of the upper portion of the Upper zone. Approximately 125,000 tonnes of mineralized material were mined and toll-milled at the nearby Brunswick 12 mill to produce saleable zinc, lead-silver and copper-gold concentrates. Reconciliation of the trail mining indicated that the uppermost portion of the Upper zone contained an average grade of 4.82% zinc, 1.60% lead, 0.44% copper and 44 g/t silver.

Trevali also carried out a 24-hole underground drilling program to better defined the mineralization in the Upper zone as part of the test mining program in 2012.

8.2 Stratmat

During the summer of 2013, Trevali carried out ongoing geotechnical and mineral resource definition drilling. Also during 2013, Trevali commissioned Stantec Consulting to carry out environmental baseline studies and archeological impact assessments on the Stratmat project. The aim of the above-described programs was to provide additional information required to make a technical decision on the potential of deposits to possibly support a new stand-alone milling facility.

The only other exploration activity carried out on the Stratmat project consists of diamond drilling which is described in Section 9 of this report.

9 Drilling

9.1 Halfmile Project

Diamond drilling on the Halfmile portion of the project was carried out by several companies prior to Trevali acquiring the project. Drilling began in 1955 and 429 of the 495 holes were drilled prior to 2010. Limited information is available on the drilling programs prior to Noranda's involvement in 1987. Table 11 summarises the drilling targeted at the Halfmile portion of the Project.

Little is known about the drilling procedures for the drilling campaigns prior to 2010. Most historical drilling programs are summarized in assessment reports filed with the New Brunswick government whichoffer only a brief and incomplete summary of the drilling programs. Wardrop (2011) offers a good summary of all assessment reports filed with the Government.

All drill programs were carried out by independent contract drillers. For drilling programs before 1974 (Noranda), no down hole azimuth data were collected. Down hole dip deviations were measured with a simple acid test. The exact location of these holes is therefore suspect but because most holes were targeted at the Upper and North zones and are relatively shallow, the deviation of the holes is not expected to be very large.

Between 1974 and 2015, down hole survey data were collected with various down hole survey toolsbut unfortunately all were susceptible to magnetic minerals present in the host rock (pyrrhotite and magnetite). As such, when a borehole passed through zones of high magnetism, the down hole azimuth was unreliable. Most of the clearly erroneous survey data were removed from the database prior to geological modelling but SRK is of the opinion that some erroneous survey data invariably are still in the current database and are affecting the exact location of some of the drill intersection locations.

Table 11: Halfmile Project Drilling Summary

Company	Number of Holes	Length (m)	Years	Core Size	Target Tested
Conwest/Texas Gulf	161	26,634	1955-56	AX (?)	Upper and North zones
Great Sweet Grass	6	1,028	1961-66	AQ (?)	Upper zone
Noranda	266	168,858	1974-2000	BQ/NQ	Upper/Lower/North/Deep/South zones
Kria Resources	19	2,751	2010-2011	NQ	Exploration
Trevali	43	7,247	2012-2015	NQ	Upper and Lower zones
Total	**495**	**206,518**			

9.1.1 Kria Resources Drilling 2010 – 2011

In the spring of 2010, Kria Resources conducted a four-hole (495 m) diamond drill program to obtain samples for metallurgical testing of Halfmile mineralization. The program aimed to evaluate its compatibility with the Xstrata's Brunswick 12 processing processing flow sheet. All four holes were targeted at the Upper zone and all intersected significant mineralization (Table 12). The four-hole drill program was followed with a 13-hole program in 2011 totalling 2,224 m.

Table 12: Summary of Kria Resources 2010 Drilling Program at Halfmile Project

Hole-ID	Interval (m)	Zn (%)	Pb (%)	Cu (%)	Ag (g/t)	Au (g/t)
HK10-01	7.07	4.00	1.10	0.30	24.25	0.42
HK-10-02	13.74	7.20	2.49	0.28	75.40	0.72
HK10-03	5.83	7.00	2.69	0.17	53.23	0.30
HK10-04	29.25	6.87	2.23	0.46	52.01	0.86

Drilling was performed by Logan Drilling Group of Stewiacke, Nova Scotia. All holes were drilled using a diamond drill rig producing NQ size core. The main purpose of the 2010-2011 program was to better define the geology and to collect additional samples of the Upper zone mineralization for metallurgical testing. Core recovery within the sulphide zone was generally good averaging better than 90% for most intersections. Hole deviation was monitored with a single shot down hole Reflex survey instrument taking readings every 30 m down hole. Figure 9 shows the collar locations for the 2011−2012 drill program.

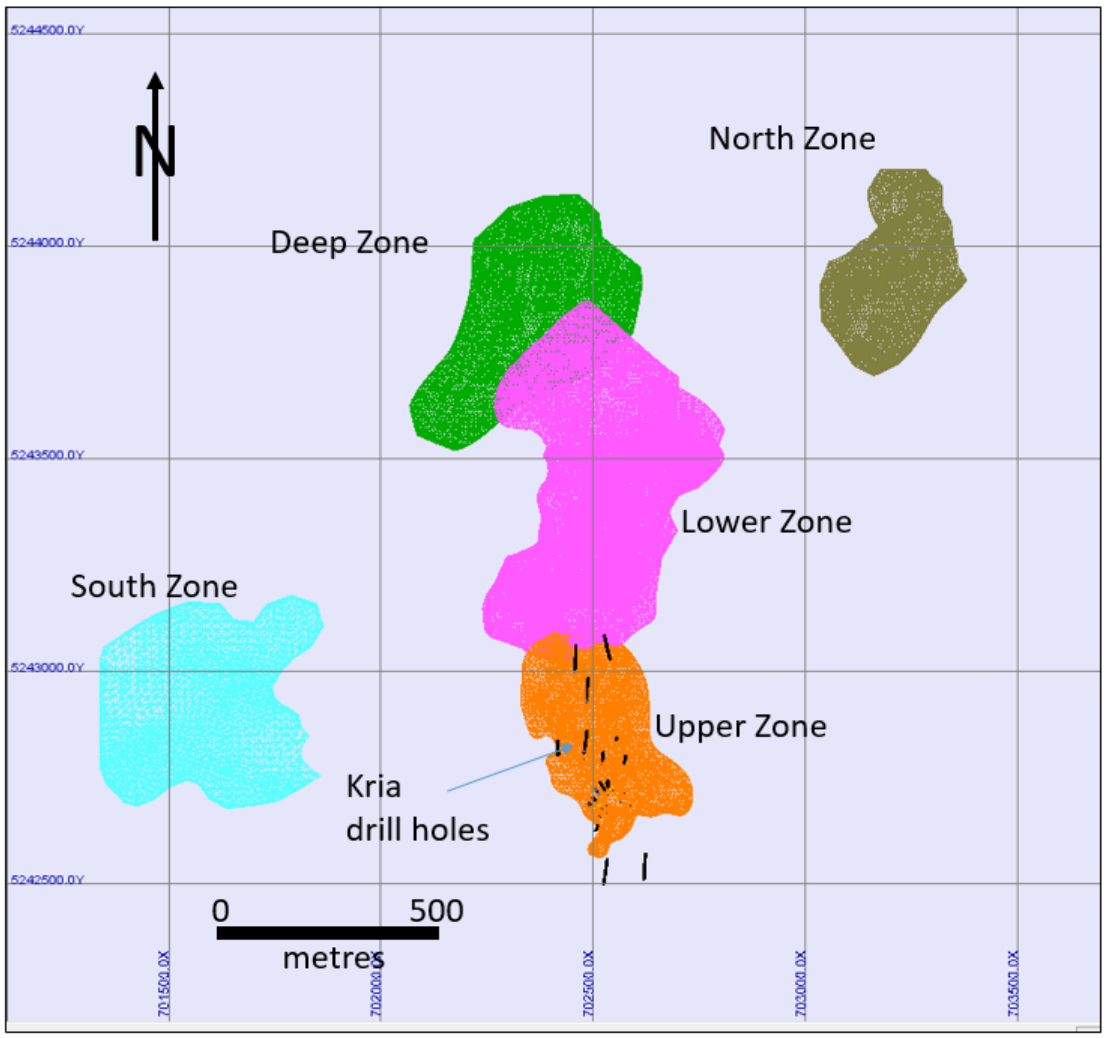


Figure 9: Plan View Showing Location of Kria Resources Drilling

Source: SRK (2016)

9.1.2 Trevali Drilling 2012–2015

In 2012, Trevali initiated an underground test mining program. As part of the underground mining, Trevali drilled twenty-four short NQ-size boreholes in the Upper zone mineralization. The goal of the drilling program was to better define the contacts of the Upper zone prior to mining. Most of the 2012 underground boreholes were either drilled at very shallow dip or vertical and intersected the mineralized zone at a shallow angle. Therefore, the drill intercepts do not represent true thickness. The true thickness of the mineralized intervals for the underground holes is only about 65 to 70% of the down hole intervals (Table 13).

In 2013, Trevali completed 2,363 m of drilling in 9 holes. The program targeted the lower portion of the Upper zone and was successful in gaining confidence and detail in the resource at tighter drill spacing. Trevali drilled an additional four surface holes in 2015 for a total length of 1,614 m. Drilling was focused at better defining the upper portion of the Lower Zone. Table 13 summarises the significant intercepts of the Trevali drilling.

All holes were drilled by Forage Spektra Inc. of Val d'Or using a diamond drill rig producing NQ core. Drill core sections were taken to the Government core facility at Madran or the temporary Trevali core handling facility at the Halfmile site for sawing. Core is stored at the Halfmile site. Core recovery within the sulphide zone was generally good, averaging better than 90% for most intersections. Hole deviation was monitored with a single shot down hole Reflex survey instrument taking readings every 30 m down hole. Some holes were surveyed with Multi shot tool and Maxibore survey tool.

Table 13: Summary of Trevali 2012-2015 Drilling at Halfmile Project

Hole-ID	Interval	Zn (%)	Pb (%)	Cu (%)	Ag (g/t)	Au (g/t)	Zone	Hole Type
HMU-001	12.74	9.22	2.90	0.36	39.19	0.28	Upper	Underground
HMU-003	15.00	3.15	0.94	0.28	23.35	0.17	Upper	Underground
HMU-006	9.16	5.23	1.55	0.34	34.38	0.30	Upper	Underground
HMU-007	9.03	5.16	1.30	0.75	51.08	0.95	Upper	Underground
HMU-009	7.54	5.73	1.18	0.19	36.98	0.70	Upper	Underground
HMU-011	12.00	5.44	1.74	0.88	37.92	0.94	Upper	Underground
HMU-014	6.70	6.30	2.27	0.31	51.92	0.64	Upper	Underground
HMU-015	10.22	5.39	1.85	0.14	39.74	0.40	Upper	Underground
HMU-018	5.60	4.33	1.47	0.24	37.12	0.39	Upper	Underground
HMU-019	8.68	5.39	2.22	0.20	45.36	0.34	Upper	Underground
HMU-022	20.27	4.00	1.20	1.34	34.76	1.00	Upper	Underground
HMU-023	9.50	6.04	2.09	0.19	32.49	0.37	Upper	Underground
HK13-20	4.24	6.41	3.34	0.13	65.95	0.32	Upper	Surface
HK13-21	9.50	7.23	2.29	0.33	59.47	0.44	Upper	Surface
HK13-25	1.49	8.72	3.34	0.08	57.13	0.27	Lower	Surface
HK13-26	5.32	4.62	1.20	0.18	16.27	0.19	Lower	Surface
HK13-27	8.86	5.37	1.30	0.30	32.11	0.38	Upper	Surface
HK13-28	2.83	6.89	3.35	0.13	48.71	0.44	Lower	Surface
HK13-32	9.61	7.45	4.44	0.04	108.76	0.32	Lower	Surface
HK13-33	3.03	3.22	0.88	0.16	13.86	0.28	Lower	Surface
HK15-034	3.00	5.57	2.11	0.03	33.49	0.11	Lower	Surface
HK15-035A	5.74	2.92	0.96	0.14	15.26	0.19	Lower	Surface

9.1.3 Trevali Drilling 2016-2017

In late 2016 and early 2017, Trevali initiated drill program to expand upon the Halfmile project geological model. Trevali drilled 28 core holes for a total of 15,175 m. Drilling was mainly focused at testing the expansions of the Upper and Lower zones at the Halfmile project.

In general, the results from the 2016-2017 drilling campaign corroborates the historic drilling completed on the project. This latest drilling increases the confidence in the resource model and provides further information about precious metal values in the Upper and Lower Zones as previous drill programs did not consistently analyze for silver or gold. The recent drilling has also facilitated an improved understanding of the local geology thus allowing for a more realistic model of mineralization that will ultimately facilitate future engineering studies. Table 14 summarizes the more significant results of the 2016-2017 drill campaign.

Table 14 Summary of Trevali 2016-2017 Drilling at Halfmile Project

Drill Hole	From - To (m)	Zone	Interval (m)	Zn (%)	Pb (%)	Cu (%)	Ag (g/t)	Au (g/t)	Approximate True Thickness
HK16-040	365.90 - 382.20	LZ	16.3	5.77	2.43	0.09	35.38	0.14	70-90%
HK16-040	(incl.) 365.90 - 375.00	LZ	9.1	6.62	3.02	0.11	45.93	0.19	70-90%
HK16-040	(incl.) 378.35 - 382.20	LZ	3.85	7.49	2.69	0.12	34.61	0.13	70-90%
HK16-041	347.00 - 357.00	LZ	10	3.9	0.67	0.11	7.52	0.18	70-90%
HK16-042	679.21 - 701.27	LZ	22.06	10.71	4.16	0.12	69.97	0.47	70-90%
HK16-042	(incl.) 683.55 - 701.27	LZ	17.72	12.6	4.89	0.09	78.32	0.5	70-90%
HK16-047	560.08 - 568.20	LZ	8.12	4.45	1.5	0.05	12.59	0.12	70-90%
HK16-047	(incl.) 560.08 - 564.76	LZ	4.68	6.36	2.03	0.08	17.26	0.16	70-90%
HK16-048	421.00 - 439.00	LZ	18	5.28	1.19	0.21	20.11	0.23	70-90%
HK16-048	(incl.) 432.00 - 439.00	LZ	7	7.37	1.75	0.2	18.84	0.2	70-90%
HK16-048	470.24 - 476.00	LZ	5.76	10.78	4.46	0.13	87.41	0.34	70-90%
HK16-050	482.47 - 510.40	LZ	27.93	5.29	1.71	0.19	23.35	0.24	70-90%
HK16-050	(incl.) 499.50 - 510.40	LZ	10.9	7.49	3.31	0.18	42.68	0.26	70-90%
HK16-051	519.60 - 523.45	LZ	3.85	9.74	1.54	0.15	48.17	0.5	70-90%
HK16-56A	717.53 - 828.00	LZ	110.47	7.86	2.34	0.11	11.11	0.12	40-60%
HK16-56A	(incl.) 756.62 - 793.79	LZ	37.17	11.38	4.05	0.14	18.27	0.21	40-60%
HK17-061	535.62 - 539.50	LZ	3.88	10.41	4.9	0.07	105.63	0.32	40-60%
HK17-061	721.13 - 769.92	LZ	48.79	3.99	0.98	0.06	17.36	0.13	40-60%
HK17-061	(incl.) 721.13 - 726.58	LZ	5.45	10.96	4.01	0.04	73.72	0.42	40-60%

9.1.4 Halfmile Project Drilling Pattern and Density

Drill spacing is highly variable depending on the zone targeted and ranges between 15 to 50 m for the Upper zone to over 120 m for the Deep zone, but on average drill spacing is in the order of 50 to 75 m within the resource area. All boreholes were designed to intersect the mineralization at right angles, but because of the steep drill angles and borehole deviation, most drill interceptions represent between 70 to 80% of the true width of the mineralized intervals. Some boreholes in the Lower Zone plot at a lower elevation than the holes surrounding them. This results in apparent “dimples” in the mineralized zone. While some of these may represent real rapid changes in dip orientation, SRK is of the opinion that these can probably be attributed to errors in down hole survey information (Figure 10). Figure 11 shows a plan view of all boreholes used for the mineral resource estimation presented in this report.

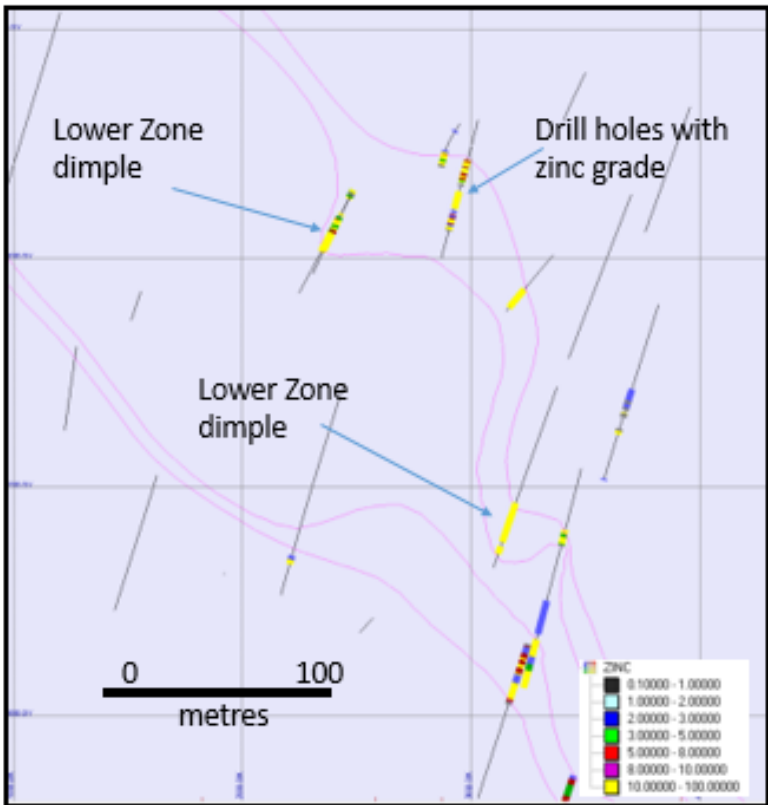


Figure 10: Cross Section of Lower Zone Showing Rapid Changes in Dip Resulting in "Dimples"

Source: SRK (2016)

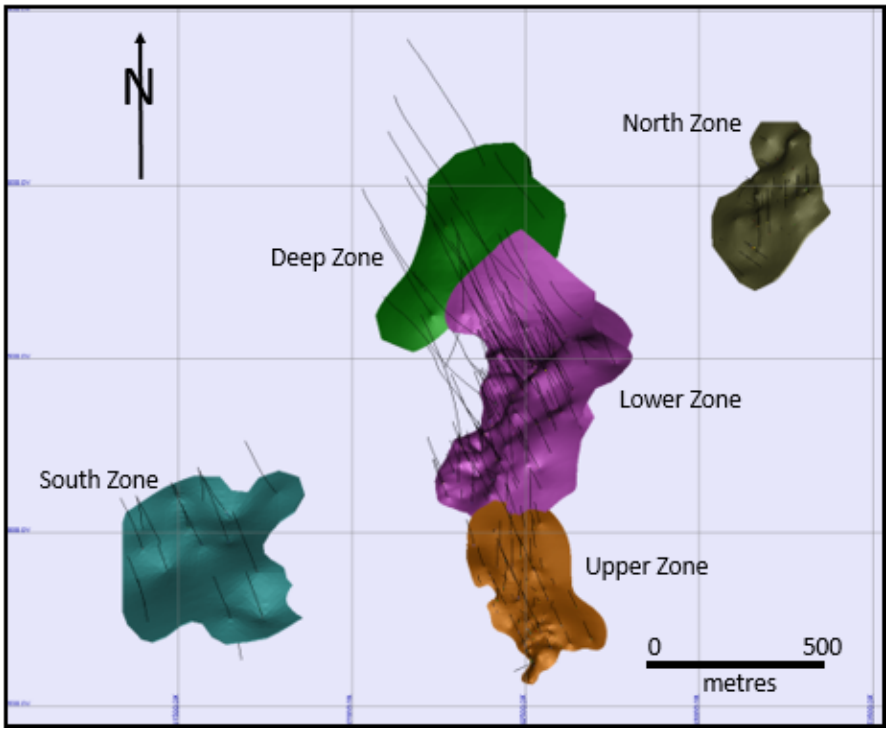


Figure 11: Drill Holes used for Halfmile Project Mineral Resource Estimate

Source: SRK (2016)

9.2 Stratmat Project

Diamond drilling on the Stratmat project was carried out by four companies prior to Trevali acquiring the project. Stratmat Ltd. completed one drill campaign from August 1956 to January 1957 with boreholes numbered 61-1 to 61-36.

- Cominco carried out nine or more drill campaigns from June 1961 through to April 1980 with boreholes numbered DDH ST-1 through ST-119.
- Noranda (for BM&S) carried out five large drill campaigns from June 1986 through December 1991. The ST series of boreholes was started by Cominco and continued by Noranda from DDH ST-120 discontinuously to ST-701.
- Xstrata completed one drill campaign during March 2005 with two holes numbered BJV-05-057 and BJV-05-059.

All historical drilling is summarized in Table 15.

Table 15: Summary of Historical Stratmat Project Drilling

Company	Number of holes	Length (m)	Year	Core Size	Target Tested
Stratmat	36	4,300	1955-56	AX (?)	Main zone
Cominco	11	1,940	1961	AQ	West zone (Boundary)
Cominco	7	345	1963	AQ	West zone (Boundary)
Cominco	2	305	1963	AQ	Exploration
Cominco	5	205	1964	AQ	Exploration
Cominco	15	3,015	1975	AQ	Main zone
Cominco	10	2,426	1980	BQ	Main and North zones
Noranda	79	14,171	1986	NQ	Boundary, S1, North and Central zones
Noranda	31	11,402	1987-88	NQ/BQ	Boundary, Main and Central zones
Noranda	39	23,791	1988-89	NQ	Central and Main zone
Noranda	53	30,147	1989-90	NQ	S1 and Main zones
Noranda	37	15,888	1990-91	NQ	S1 and Boundary deposits
Xstrata	2	708	2005	NQ	Main zone
Total	**327**	**108,643**			

9.2.1 Stratmat Ltd. Drilling (Pre-1961)

The following description of the historical drilling programs is taken from the Wardrop report prepared for Kria Resources (Wardrop 2009).

The original drilling by Stratmat Ltd. was as a follow-up to airborne and ground EM surveys and soil geochemical surveys conducted in 1955 which led to the discovery of the Main Zone in 1956. A total of 14,156 ft (4,300 m) was reported in 36 diamond boreholes (Assessment File 471509). Drilling was conducted by Boyles Bros. The boreholes were numbered 61-1 through 61-36 and include footage intervals with geology description and assays for gold, silver, copper, lead, zinc for most mineralized zones and some lower grade intervals were clearly not sampled. Core size is not indicated in the drill logs.

Stratmat Ltd. began drilling in the summer of 1956. The Main Zone was described as an elliptical body of fine grained massive pyrite replacing fractured, chloritized and silicified intermediate volcanic rocks. The massive sulphide was reported to dip between 40° and 80° to the south with a

strike of N45E and a length of 500 ft (150 m) and a highly variable width up to 100 ft (30 m). Massive sulphides have been delineated to a maximum depth of 450 ft (140 m). The deposit displayed zoning with a distinct copper rich zone (pyrite/chalcopyrite ±pyrrhotite) on the west and lead/zinc zone (pyrite with blebs and stringers of sphalerite and galena) to the east. Bulk density was estimated using samples from four boreholes and one trench sample and reported as 6.93 cubic feet per ton (ft^3/ton) or 4.62 t/m^3.

9.2.2 Cominco Drilling 1961- 1981

Drilling by Cominco began in 1961 (Assessment File 470989). The first Cominco report describes diamond boreholes ST-1 through ST-11 for a total of 6,369.5 ft (1,940 m). These holes were drilled to test the West Zone or Turam anomaly, and located 300 m east of the Boundary deposit, with a coincident weak lead soil geochemical anomaly (see Figure 5). The core size was not specified in the drill logs but work reports from that era indicate the core size was predominantly AXT or AQ. The drill logs describe geology intervals and mineralized zones with metal value estimates but no core intervals are indicated as sampled and assays were not included. Massive sulphide intervals up to 12 ft (3.5 m) are reported, principally with pyrite and up to 30% sphalerite and 10% galena. The logs indicate sulphides are associated with argillite horizons within a felsic volcanic sequence of rocks.

A 1963 assessment report describes seven diamond boreholes totaling 131 ft (345 m) (Assessment File 472386). The boreholes are numbered ST-12 through ST-18 and were targeted on the extension of the West Zone described in the first Cominco report. A total of 45 core samples were collected, however no assays were included with the report. The sample intervals of the drill core were generally ten feet or less often five feet.

Two boreholes, numbered ST-28 and ST-29, were drilled in 1963 for a total of 1,002 ft (305 m) (Assessment File 470991). No significant mineralization was reported and no samples were reported as collected for analysis.

Five boreholes were completed in the spring of 1964, numbered ST-56 through ST-60, for a total of 674 ft (205 m) (Assessment File 471574). A total of 32 core samples were collected ranging from 1 to 6 ft with most samples 5 ft (1.5 m). No assay results were reported.

Fifteen diamond boreholes, numbered ST-61 through ST-75, were reported in 1975 for a total of 9,892 ft (3,015 m) (Assessment File 471355). Assay results for all sulphide mineralized intervals were included for copper, lead, zinc and silver. Some samples were also assayed for gold, cadmium and bismuth. Core size was indicated as AQ.

Ten diamond boreholes completed in 1980, numbered ST-110 through ST-119, were reported in 1981 for a total of 2,426.6 m of BQ core (Assessment File 472679). Sample length was generally 1.5 m but some samples were as short as 0.5 m. Assay results for mineralized zones were reported for copper, lead, zinc, silver and iron. Occasional samples were analyzed for gold. Seven holes were drilled into the North zone to explain coincident geophysical and geochemical anomalies. Three holes were drilled to extend the CentralZ.

9.2.3 Noranda Drilling 1986 -1991

Noranda began diamond drilling on the project area in 1986 (Assessment File 473385). A total of 79 NQ diamond boreholes totalling 14,171.5 m were completed, numbered ST-120 through ST-217. The drill program focused mainly on the Boundary deposit to define geological resources. Five metallurgical HQ holes totalling 447.14 m were completed on the Boundary deposit, ST-M1 through ST-M5. Twelve of the 79 holes were located on the Central Zone for a total of 3,142.6 m to evaluate

mineralization located in previous work by Cominco. The S-1 lens was first intersected in this program with holes ST-206 and ST-207. Three holes were also completed on the North zone with disappointing results.

Delineation of the Boundary project continued in 1987-1988 (Assessment File 273544) with boreholes ST-242 to ST-281 and ST283 to ST-288. Additional drilling included:

- Main zone: ST-218 to ST-224; 61-17 deepened; and ST-233 to ST-239
- Central zone: ST-225 to ST-232
- Boundary east lens: ST-282
- Boundary fold closure: ST-83, HS-627 deepened
- Turam zone: ST-230, ST-231, ST-240

Diamond drilling totalled 11,402.3 m of NQ and BQ core in 31 holes. Results for diamond drilling plus the exploration decline into the Boundary deposit and 3,000 tonnes bulk sample were used for the feasibility study for Boundary deposit and evaluation of the other zones to determine geologic resources.

Diamond drilling during 1988 and 1989 totalled 39 holes for a cumulative total of 23,791.2 m of predominantly NQ core in boreholes numbered ST-196 through ST- 345 and N-3-19 (Assessment File 473748) and included the deepening of some previously drilled holes. Most of the drilling targeted the Central Zone area including S-1. It was noted that structure and stratigraphy of the project was complex, making it difficult to correlate ore zones from section to section. Three holes were drilled on the North zone and five holes were deepened to continue the 200 m spaced evaluation. Additional drilling to extend significant mineralized intercepts was not successful. One hole was drilled into both the Main Zone and Turam Zone to extend the mineralization at depth. Results were generally negative.

Diamond drilling during 1989 and 1990 (Assessment File 474129), including wedges and deepening of various holes, totalled 30,147.3 m in 53 holes with DDH numbers in the sequence of ST-192 to ST-385. Drilling was directed at the S-1 deposit which represents the largest mineral inventory on the property and the focal point of the exploration program. Deep boreholes targeting the S-1 deposit and drilled to the north were collared on the Heath Steele ML. Seven holes were drilled on the Main Zone and five holes on the Central Zone #2 Lens to test for extensions of mineralization. The principal problem reported with drilling was excessive deviation caused by the S2 foliation. The problem was most severe with deeper holes.

Thirty-seven diamond boreholes including wedge cuts and deepening were completed for a total of 15,877.8 m of predominantly NQ core during the period of August, 1990 to December 31, 1991 (Assessment File 474408). A large percent of the drilling targeted the down dip extension of the S-1 deposit and the stratigraphic horizon between the S-1 deposit and the Boundary deposit as well as Pulse EM geophysical anomalies.

9.2.4 Xstrata Drilling 2005

In 2005 two diamond boreholes were targeted on airborne Mega TEM anomalies adjacent to the Main Zone along strike from the deposit (Assessment File 476044) for a total of 708 m. The mineralized horizon was intersected in both holes with negative results.

9.2.5 Trevali Drilling 2011-2012

Between October 2011 and February 2012, Trevali drilled a total of 4,895 m in 21 holes. Drilling was performed by Logan Drilling Group of Stewiacke, Nova Scotia. All holes were drilled using a diamond drill rig producing NQ size core. The main purpose of the 2011−2012 program was to better define the geology and to collect additional samples of the Main Zone mineralization. Core recovery within the sulphide zone was generally good averaging better than 90% for most intersections. Hole deviation was monitored with a single shot down hole Reflex survey instrument taking readings every 30 m down hole. Figure 12 shows the collar locations for the 2011−2012 drill program.

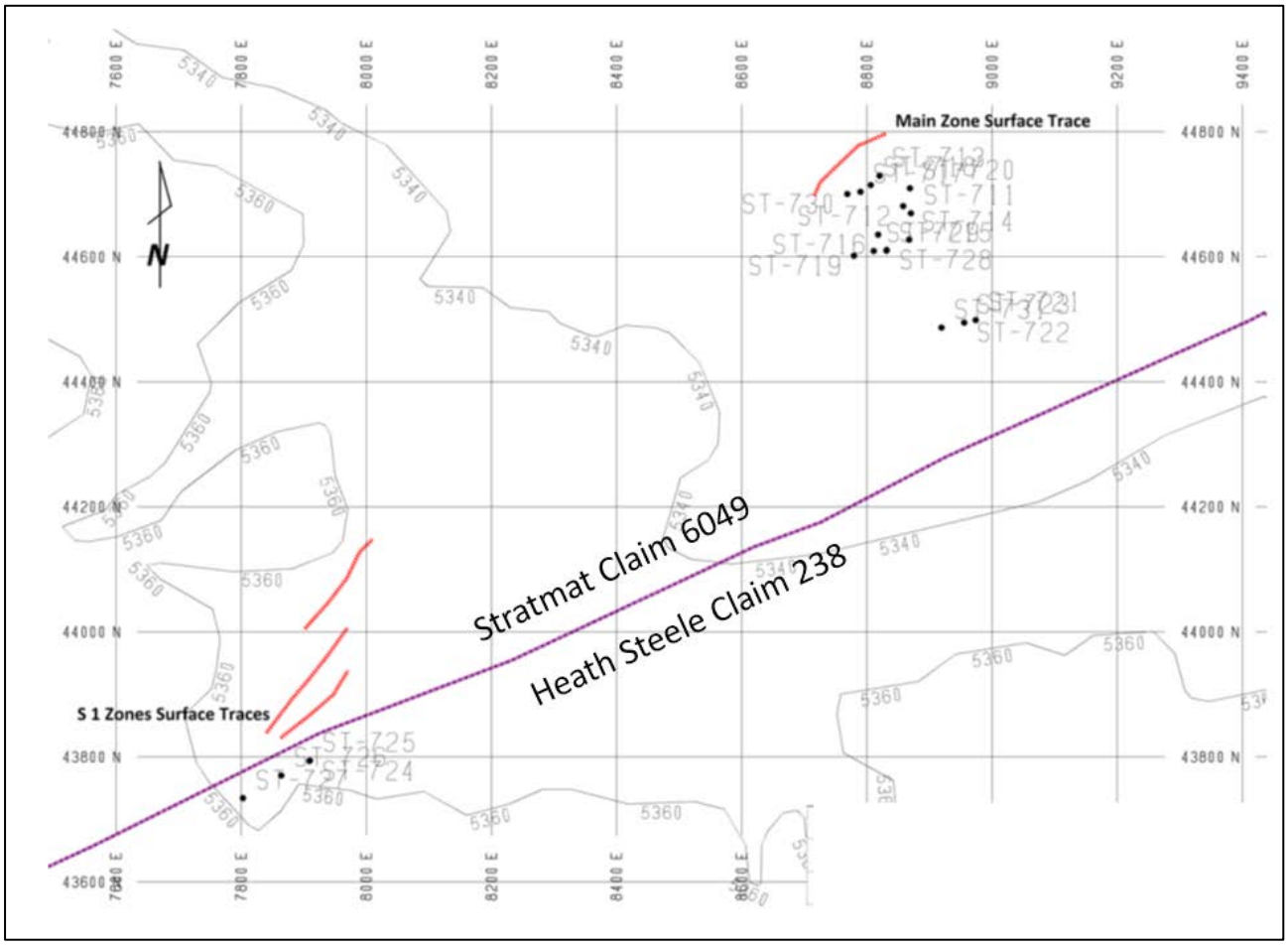


Figure 12: Collar Locations for the 2011−2012 Stratmat ProjectDrill Program

(Note: Grid is 200 m by 200 m)

Source: Trevali (2014)

9.2.6 Trevali Drilling 2013

In the summer of 2013, Trevali initiated a follow up drill program to better define the targets identified during the 2012 drilling and to increase the knowledge of the top 200 m of the S1 zone. In total, 5,510 m were drilled in 18 holes. All holes were drilled by Forage Spektra Inc. of Val d'Or using a diamond drill rig producing NQ core. Drill core sections were taken to the Government core facility at Madran or the temporary Trevali core handling facility at the Halfmile site for sawing. Core is stored at the Halfmile site. Core recovery within the sulphide zone was generally good averaging better than 90% for most intersections. Hole deviation was monitored with a single shot down hole Reflex survey instrument taking readings every 30 m down hole. Some holes were surveyed with Multi shot tool and Maxibore survey tool. Figure 13 shows the collar locations for the 2013 drilling program.

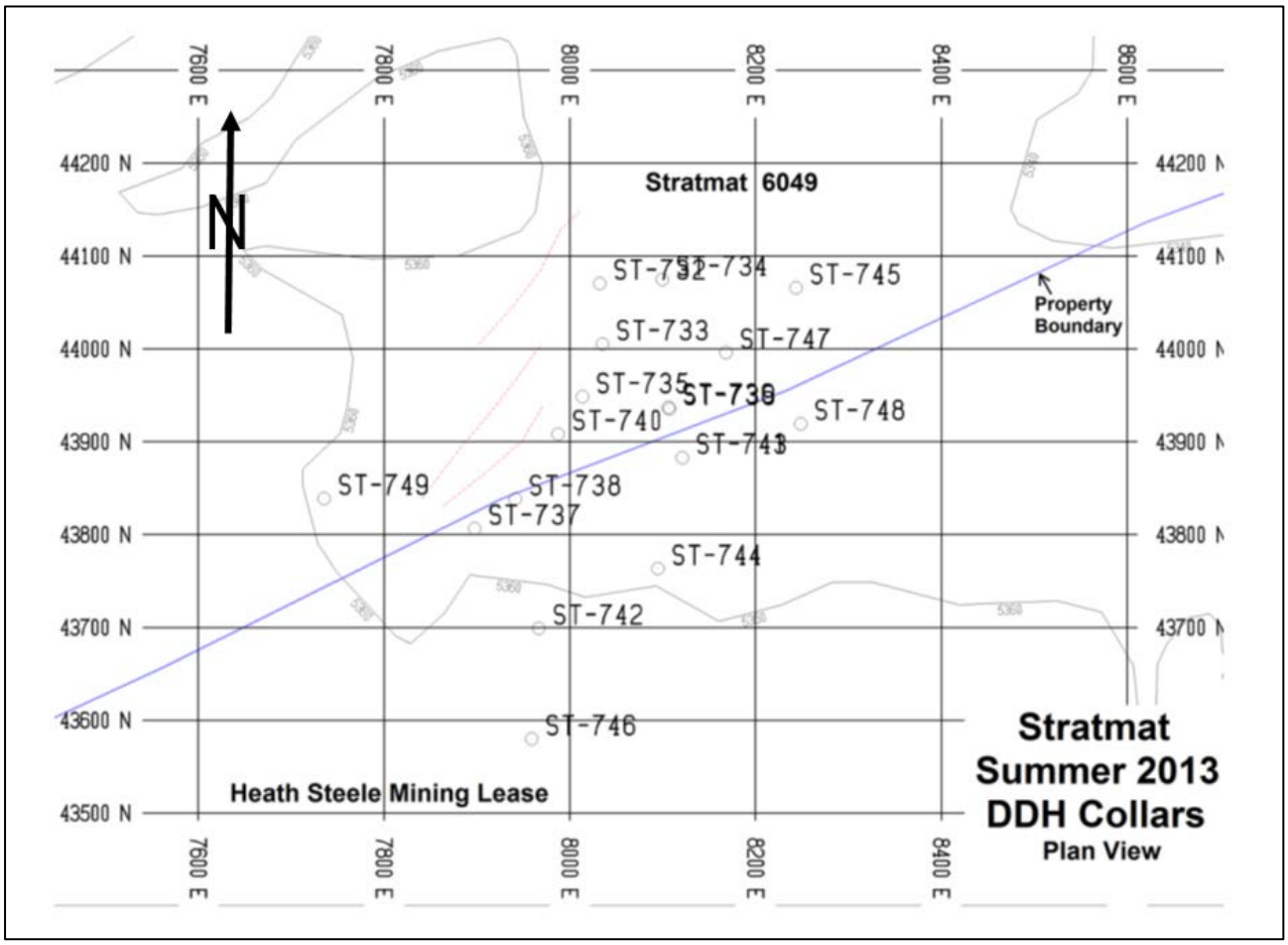


Figure 13: Collar Locations for the 2013 Stratmat Project Drill Program

(Note: Grid Lines are 200 m East-west and 100 m apart North-south)

Source: Trevali (2014)

9.2.7 Trevali Drilling 2013–2014

In October 2013, Trevali initiated a follow up drill program to better define the targets identified during the 2013 summer drill program. A total of 8,190 m was drilled from 12 holes. All holes were drilled by Forage Spektra Inc. of Val d'Or using a diamond drill rig producing NQ core. The core was logged and processed at the temporary Halfmile core facility site. The sulphide mineralized core sections were logged and sampled at the temporary Trevali core handling facility at the Halfmile site. Core is stored at the Halfmile site. Figure 14 shows the collar locations of the 2013-2014 drill program.

In total, Trevali drilled 18,595 m in 51 holes on the Stratmat project. The drill programs were successful in expanding and defining the mineralization at Stratmat, collecting geotechnical information and led to the discovery of a new mineralized lens, between the Main and the S5 zones. Some of the more significant intercepts are summarized in Table 16.

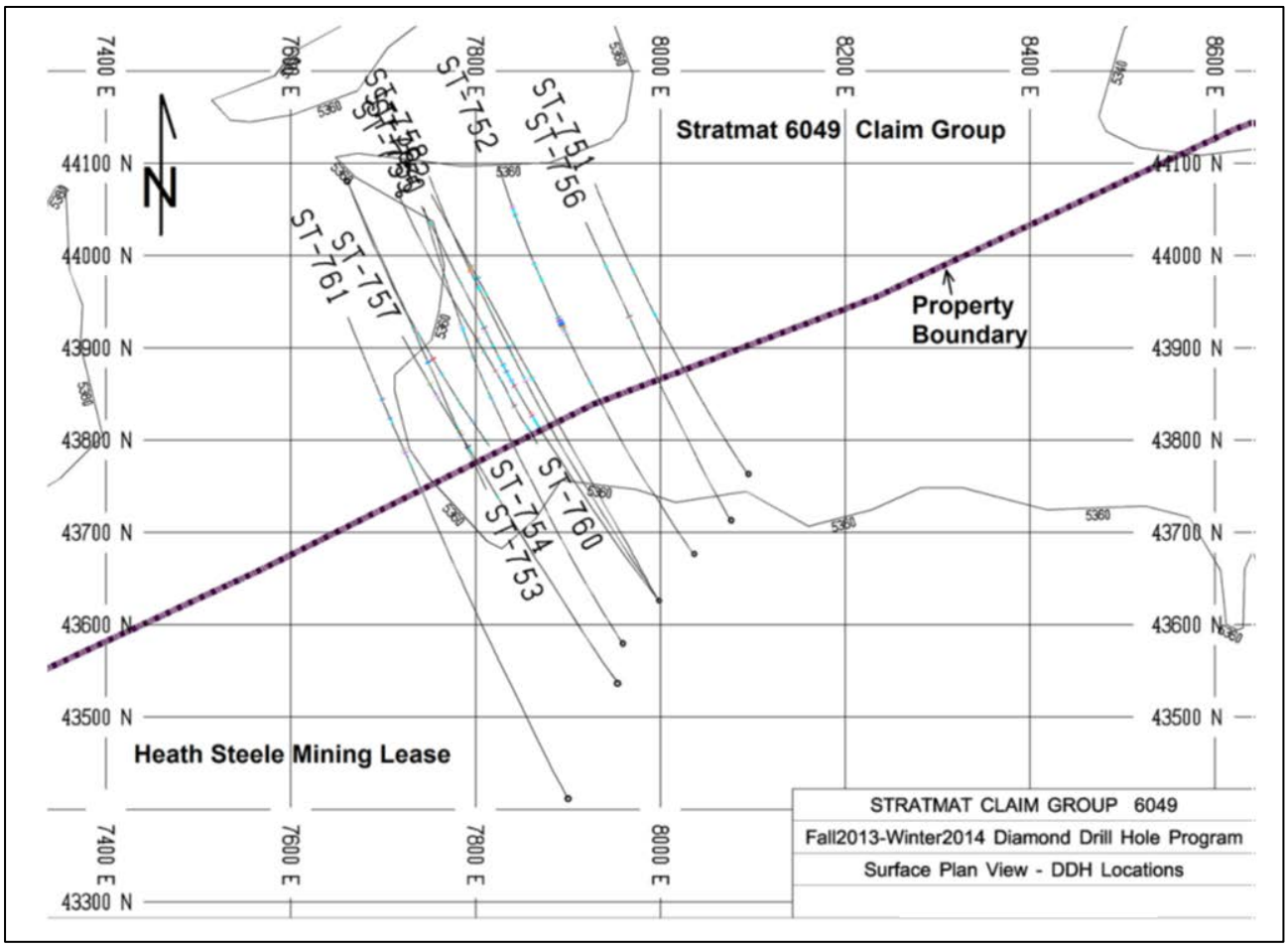


Figure 14: Collar Locations of the 2013-2014 Stratmat Project Drill Program
(Note: Grid Lines are 200 m East-west and 100 m apart North-south)
Source: Trevali (2014)

Table 16: List of Significant Drill Hole Intersections for the Stratmat Project

Hole-ID	From (m)	To (m)	Interval	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)	Zone
61-017	111.30	127.10	15.80	3.15	8.40	0.50	108	0.965	Main
ST-058	25.82	32.71	6.89	5.16	9.67	1.07	0	0.000	S1 Shallow
ST-067	199.04	205.13	6.09	3.47	2.98	1.07	12	0.000	S1 Shallow
ST-192	114.10	123.50	9.40	3.26	4.95	0.57	38	0.142	S1 Shallow
ST-192	231.50	238.60	7.10	2.77	5.85	0.36	49	0.411	S1 Shallow
ST-204	285.60	295.10	9.50	3.56	7.57	0.83	61	0.340	S1 Shallow
ST-218	107.85	131.35	23.50	2.00	5.88	0.12	68	0.824	Main
ST-223	141.20	158.60	17.40	3.10	7.85	0.69	79	0.601	Main
ST-229	440.65	459.80	19.15	2.54	6.29	0.19	69	0.331	S1 Deep
ST-234	295.95	317.28	21.33	3.32	6.15	0.22	75	0.291	Main
ST-309A	715.60	747.60	32.00	2.23	5.97	0.24	49	0.886	S1 Deep
ST-329	550.55	589.35	38.80	2.71	5.88	0.14	64	0.798	S1 Deep
ST-335	739.50	765.85	26.35	2.14	4.80	0.69	41	0.721	S1 Deep
ST-343	854.30	891.20	36.90	1.07	2.54	0.28	19	0.166	S0
ST-343A	821.95	882.40	60.45	1.93	4.73	0.49	29	0.271	S0
ST-345	242.86	254.15	11.29	4.98	7.25	1.50	85	4.149	S1 Deep
ST-347	529.70	548.15	18.45	3.58	10.36	0.38	105	1.152	S1 Deep
ST-350A	493.50	519.85	26.35	1.80	5.42	0.52	53	0.427	S1 Deep
ST-374	12.30	19.55	7.25	0.18	1.36	3.53	21	0.324	Main
ST-381	39.20	49.85	10.65	5.55	11.14	0.53	93	0.379	S1 Shallow
ST-384	20.95	27.90	6.95	2.43	2.83	1.41	43	0.197	Main
ST-414	86.65	95.44	8.79	4.47	9.32	0.70	46	0.202	S1 Shallow
ST-712	115.92	129.80	13.88	2.41	7.34	0.41	70	0.909	Main
ST-725	120.00	127.00	7.00	2.58	4.82	0.80	31	0.263	S1 Shallow
ST-726	56.98	65.45	8.47	4.18	7.48	0.33	42	0.156	S1 Shallow
ST-752	430.78	458.85	28.07	1.27	6.93	1.14	88	2.214	S1 Deep
ST-758	636.55	642.81	6.26	2.65	7.45	0.15	63	0.909	S1 Deep
ST-763	462.80	470.80	8.00	0.89	2.88	0.24	28	0.983	New
ST-763	486.88	494.50	7.62	0.00	0.16	1.81	12	0.574	New
ST-769	71.80	79.03	7.23	4.05	7.48	0.28	50	0.325	S1 Shallow
ST-780	634.44	639.44	5.00	0.02	0.06	3.44	18	0.656	New
ST-785	406.76	412.02	5.26	3.63	8.55	0.55	52	0.153	S5
ST-786	467.12	486.72	19.60	2.32	5.28	0.62	68	0.834	S1 Deep
ST-791A	481.46	488.83	7.37	2.05	6.39	0.56	24	0.471	S1 Deep
ST-793	370.40	376.10	5.70	6.81	15.59	0.55	96	0.218	S5
ST-796	429.00	441.70	12.70	2.51	6.41	0.24	74	0.735	S1 Deep
ST-797	574.60	592.80	18.20	0.02	0.12	2.97	9	0.252	New
ST-804	380.07	392.44	12.37	3.39	7.90	0.44	42	0.195	S5

9.2.8 Stratmat Project Drilling Pattern and Density

Drill spacing is highly variable depending on the zone targeted and ranges between 15 to 50 m for the S1 Shallow zone to over 120 m for the S1 Deep zone but on average, drill spacing is in the order of 50 to 75 m within the resource area. All boreholes were designed to intersect the mineralization at right angles but because of the steep dip, most drill interceptions represent between 70 to 80% of the true width of the mineralized intervals. Some boreholes in the S0 zone intersect the mineralization almost parallel to the strike of the mineralized lens. Figure 15 shows a plan view of all boreholes used for the resource estimation presented in this report.

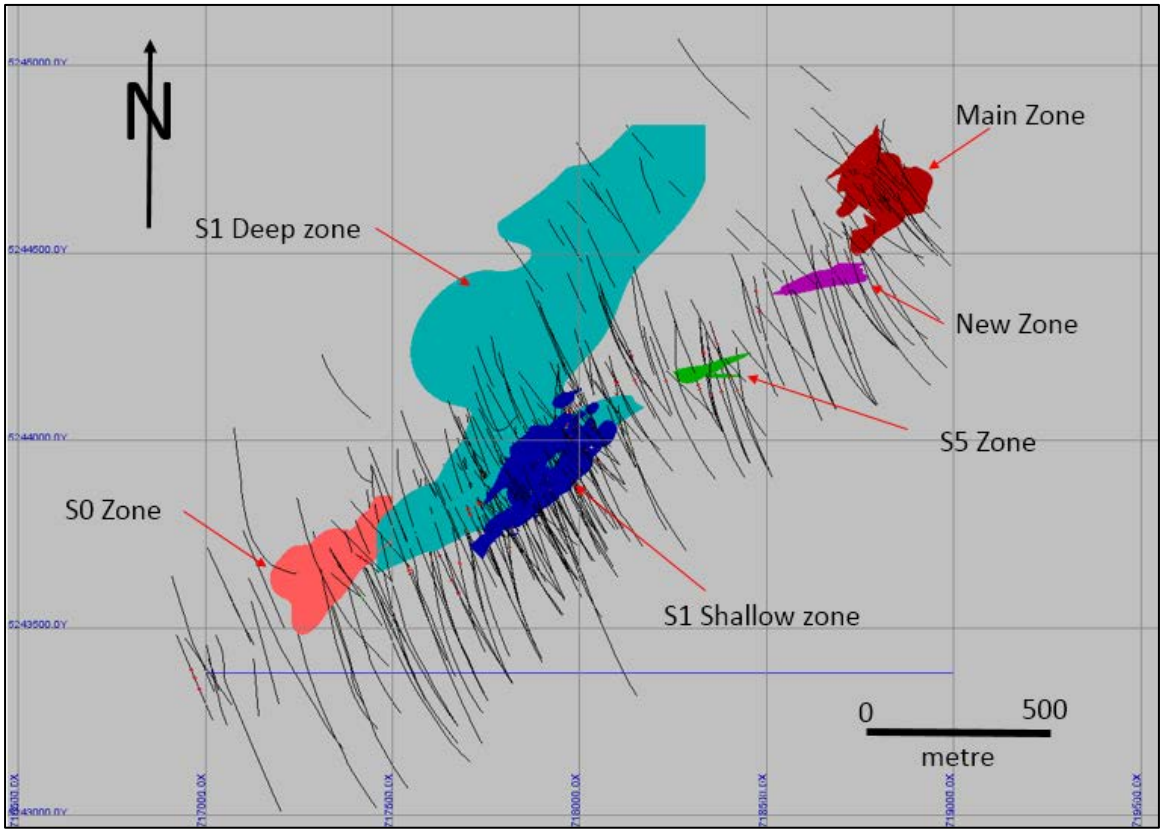


Figure 15: Map Showing the Distribution of Historical and Current Drilling in Relation to the Mineralized Zones at Stratmat Project

Source: SRK (2015)

9.3 SRK Comments

SRK is of the opinion that the drilling density at the Halfmile and Stratmat projects is sufficient to support the estimation of a mineral resource. While the details of the quality assurance and quality control (QA/QC) protocols for some of the older historical drilling are not known, most of the historical drilling was carried out by major mining companies and would have utilized the best quality control protocols available at the time. SRK, however, noted that some of the down hole survey data collected from the historical drilling at the Halfmile project seemed to have been adversely affected by magnetite and pyrrhotite resulting in somewhat uncertain locations for some of the borehole intersections.

10 Sample Preparation, Analyses, and Security

10.1 Halfmile Project

10.1.1 Halfmile Project Sample Preparation

There is no reference in the government assessment reports about the sampling methods used by companies prior to Noranda's involvement in the project. The core is no longer available for examination. Drilling for most of the historical programs was logged in feet. Samples were collected by splitting the core with a manual core splitter. Sample lengths were either 5 or 10 feet (1.5 or 3.0 metres). Assays would have beenconducted by a commercial laboratory using standard wet chemistry procedures that were common at the time of drilling.

Sample preparation for the Noranda drilling programs is described by Côté (2001). Sample preparation for the Noranda drilling was carried out at the Brunswick 12 mine site. The sample preparation lab was equipped with a dust control system to minimize contamination withcrushing and pulverizing equipment were located in separately enclosed rooms.

The drill core samples were delivered from the core shack to the sample preparation room by a dedicated sampling technician. Each core sample plastic bag was identified with a plastic bar code system tagged by the geology department. The plastic tag included the sample number and the location of the sample (diamond borehole number, From - To intervals in meters). The sample numbers were recorded in a logbook upon reception at the sample room.

Trevali sampling program was carried out by Trevali employees. Core was brought to the Halfmile site for logging. The core was first photographed and logged by a Trevali geologist. The core was then marked for sampling. Sample lengths were generally 1 m in length and sample intervals were interrupted at geological or alteration contacts. Generally, samples less than 0.3 m were not collected. Once logged and marked, the core was cut lengthwise with a diamond cutting saw at the site. Samples were bagged, sealed with a tamper proof seal and shipped to the assay laboratory by contract shipping company.

10.1.2 Halfmile Project Analyses

All Noranda samples were crushed in a jaw crusher and reduced to approximately 4 mesh. Each sample was then transferred to a roll crusher and the materials reduced from 4 to 20 mesh. The material was separated in a riffle splitter to obtain a homogenous split. One portion of the sample was labelled with a bar code number, named "Reject" and was sent back to the core shack for storage. Rejects were normally saved for a period of six to seven years. No reject material is currently available.

The other portion of the sample was further reduced with a disc pulverizer to obtain a size of about 100 mesh. To minimize contamination during sequential sample preparation, the pulverizer was cleaned with a high-pressure air hose after passing each sample though the pulverizer. About 50 grams of rock powder ("the pulp") were then transferred to a previously labelled pulp bag. The labelled pulp samples were then sent to the mine assay laboratory for analysis.

The diamond drill samples were routinely assayed for lead, zinc, copper and silver. Gold was analyzed occasionally, when requested by the geologists. The analytical procedures followed by the laboratory were standard for sulphide minerals assays. All samples were analyzed by flame atomic absorption spectroscopy (FAAS) for lead, zinc, copper and silver. For those samples which exceeded the upper calibration limits, titrametric or gravimetric methods were used. These procedures followed were derived from International System Organization (ISO) and standard in base metal industries.

The FAAS analytical procedures used a 1 gram split of the sample digested in acid (HCl and HNO_3). Results were estimated based on calibration curves produced from in-house reference material. The atomic absorption spectrometer was calibrated with three in-house reference materials prepared as solutions in the same manner as that used for the samples.

These reference materials were prepared by Brunswick Laboratory technician and previously analyzed by external laboratories, along with titration or gravimetric ISO procedure. The material used for the preparation of these standards was ore from Brunswick Mine. While the laboratory at Brunswick Mine was not internationally certified, the laboratory was used to assay the mine concentrate which was sold internationally. The laboratory routinely participated in international round-robins and acted as umpire lab on some occasions.

Trevali has used Activation Laboratories (ActLabs) Ltd. of Ancaster, Ontario to process core samples from the Halfmile drilling. ActLabs used a sample preparation facility located in Fredericton New Brunswick and assay facilities in Ancaster. Samples sent to ActLab for assay were analysed by fire assay for gold and ICP for the base metals. The gold fire assay method used 30-g pulp. The sample was mixed with fire assay fluxes (borax, soda ash, silica, and litharge), with Ag added as a collector and the mixture was placed in a fire clay crucible. The mixture was then preheated to 850°C, intermediate 950°C and finish 1060°C with the entire fusion process lasting 60 minutes. The crucibles were then removed from the assay furnace and the molten slag (lighter material) was removed leaving a lead button. The lead button was then placed in a preheated cupel which absorbs the lead when cupelled at 950°C to recover the silver (doré bead) + gold. The entire silver doré bead was dissolved in aqua regia and the gold content was determined by atomic absorption (AA).

For base metals, a 0.5 g sample was digested in aqua regia at 90 °C in a microprocessor-controlled digestion block for 2 hours. Digested samples were diluted and analyzed by Perkin Elmer Sciex ELAN 6000, 6100 or 9000 ICP/MS.

ActLab facilities in Ancaster comply with the ISO/IEC 17025 standard which is used by testing and calibration laboratories. There are two main sections in ISO/IEC 17025 - Management Requirements and Technical Requirements. Management requirements are primarily related to the operation and effectiveness of the quality management system within the laboratory. Technical requirements address the competence of staff, methodology, test/calibration equipment and the test methods. In 1998 Actlabs was one of the first labs in North America to attain this accreditation.

10.1.3 Halfmile Project Sample Security

No information was provided on the security taken by Noranda to assure sample integrity and no information is available on the nature or extent of the quality control procedures that Noranda implemented during the drilling program at the Halfmile project. However, senior mining companies such as Noranda all carried standard quality control procedures that would have included the use of standard reference material (SRM) and blanks. The rate at which these were used or the procedures followed at the time are no longer available.

Trevali on-site personnel collected and tracked samples which were then security sealed and shipped to the assay laboratory for crushing and splitting and assaying. Analytical accuracy and precision were monitored by the analysis of reagent blanks, reference material and replicate samples.

10.1.4 Halfmile Project Quality Assurance and Quality Control Programs

No information is available on the QA/QC programs used for the historical drilling at the Halfmile project. SRK doubts that any QA/QC programs were used for drilling prior to 1980 as the practice of inserting standards and blanks only became common in the 1990s. SRK is of the opinion that Noranda very likely inserted blanks, standards and used field duplicates in their drilling campaign as this was common practice at the time. However, the information is not available in any of the assessment reports available for the Halfmile project and none of the reports examined described QA/QC procedures used by Noranda.

For the 2010 and 2012 drilling programs, Kria Resources inserted blanks and SRM with each sample batch dispatched to the assay laboratory. General practice was to insert two SRM and one blank for every batch of thirty samples. Kria Resources inserted field duplicates only in underground drilling once mining operations were underway. All QA/QC samples were reviewed internally by Kria Resources. No formal report was done at the time.

Trevali inserted blanks, SRM and field duplicates with each sample batch dispatched to the assay laboratory. The general practice was to insert two SRM, four field duplicate and one blank with every batch of forty samples. All QA/QC samples were reviewed and monitored by Reflex Geochemistry (Reflex).

Reflex monitored the 2013 program and concluded that the blanks showed very little to no contamination issues. One outlier might represent a misplaced sample, or be directly in sequence with a preceding high-grade sample. The quartzite blank performed well to monitor potential Au and Ag contamination, but the base metal levels were relatively high pointing to some possible contamination issues.

Trevali has been following the same QA/QC procedures for all drilling campaigns since 2013. The quality control data were monitored by the field geologist and for sample batches with SRM outside of 3 standard deviation of the expected value, the entire batch was re-assayed prior to being entered in the database.

10.2 Stratmat Project

10.2.1 Stratmat Project Sample Preparation

There is no reference in the government assessment reports about the sampling methods used by Stratmat Ltd. or Cominco Ltd. The drill core directory for the Heath Steele core storage site does not make reference to drill core from these operations. The core is no longer available for examination.

The Stratmat program was contracted to Boyles Bros. and resulted in 36 boreholes for a total of 14,156 ft (4,300 m). The core size is not indicated in the logs or the reports but was very probably AXT which was typical of that era. Drill core selected for sampling was based on sulphide content and economic mineralization, which is evident from the lithological description. The preferred sample length was five feet (1.52 m) with only a few of the samples being as short as one foot (0.3 m). Sludge samples were often collected in massive sulphides with one sample representing an entire interval. Eight holes did not intersect significant mineralization and were not sampled.

Core size, where noted in the Cominco drill program, was AQ except for their last drill campaign in 1980 when they went with BQ. This was probably split with a hand operated core splitter with half of the core sample bagged and sent to the lab. Sample size was variable with most being 5 feet or 1.5 m when logging was in metres. Sampling of sulphides was consistently based on the lithological description.

Sampling method and approach was also not documented for the work carried out by Noranda Exploration Company Limited on behalf of BM&S. The core logging and storage facility at the Heath Steele Mine site was used to process the Stratmat core. The NQ core samples were identified and marked by the geologist. Core samples were cut using a diamond saw. Core sample length was highly variable dependent on the mineralization. Samples were mostly less than or equal to 1.5 m. Half of the core sample was bagged and probably transported by truck to one of the lab facilities operated by Noranda, Brunswick Mine or Custom Lab, a local lab adjacent to the Noranda office. The drill core for most of the Noranda drilling is stored at the Heath Steele core storage facility. The core is cross piled in the open and is in deteriorating condition.

Xstrata operated a core facility at the Brunswick 12 Mine. A building was dedicated for this use and was clean and well organized, with experienced personnel handling the samples. Samples of all mineralized intersections were split with a saw, generally in sample lengths of 1 m. The samples were transported to the prep lab and later to the assay lab on the mine site by mine personnel. Drill core is stored in the core storage facility at the Heath Steele Mine site.

Trevali's sampling program was carried out by Trevali employees. Core was brought to the Halfmile site for logging. The core was first photographed and logged by a Trevali geologist. The core was then marked for sampling. Sample lengths were generally 1 m in length and sample intervals were interrupted at geological or alteration contacts. Generally, samples less than 0.3 m were not collected. Once logged and marked, the core was cut lengthwise with a diamond cutting saw at the site. Samples were bagged, sealed with a tamper proof seal and shipped to the assay laboratory by a contract shipping company.

10.2.2 Stratmat Project Analyses

There is no reference in the government assessment reports about the assaying methods or procedures used by Stratmat Ltd. or Cominco Ltd. Core samples collected by Noranda were assayed at Custom Laboratories Ltd. in Bathurst. All samples were crushed to ¼ inch and a 200 g portion was pulverized to less than 100 mesh. A sub-sample of 0.5 or 1 g in size was digested with hydrochloric and nitric acids and copper, lead and zinc were determined by atomic absorption. Gold was determined by fire assay method with an atomic absorption finish using a 14.6-g sample fused at 2000°F. SRK is not aware of the certifications or accreditations that Custom may have operated under at the time that the assays were carried out.

Trevali has used both ACME Laboratories (ACME) of Val D'Or, Quebec and Activation Laboratories (ActLabs) Ltd. of Ancaster, Ontario to process core samples from the Stratmat Project. ActLabs used a sample preparation facility located in Fredericton, New Brunswick, and assay facilities in Ancaster. Table 17 summarizes the laboratory usage by boreholes and dates.

Samples sent to ACME were analysed by fire assay with an atomic absorption finish for gold and by ICP for the base metals.

Table 17: Laboratory Used by Drill Holes

Laboratory	Date Used	Drill Holes
ACME	July 19, 2013 to Sept 14, 2014	ST732-748
ActLab	Oct 23, 2013 to Feb 11, 2014	ST750-755, 757, 758, 760
ACME	July 15, 2014 to Oct 30, 2014	ST763, 767, 776, 780, 785
ActLab	Jan 2014 to Feb 21, 2014	ST756, 759, 761, 762
ACME	April 6, 2014 to Dec 14, 2014	ST764, 768-775, 777, 778, 779, 781-804

The gold fire assay method used 30-g pulp. The sample was mixed with fire assay fluxes and with Ag added as a collector and the mixture was placed in a fire clay crucible. The entire Ag dore bead was dissolved in aqua regia and the gold content was determined by AA.

The base metal assays were carried out by multi-acid digestion where a 0.25-g split was heated in HNO_3-$HClO_4$-HF to fuming and dried. The residue was dissolved in HCl and base metal contents were determined by ICP-ES.

ACME used its facility in Val D'Or for crushing and splitting coarse rejects while the assays were carried out at their facility in Vancouver, BC. ACME's quality system complies with the requirements for the International Standards ISO 9001:2000 and ISO 17025: 1999. Analytical accuracy and precision are monitored by the analysis of reagent blanks, reference material and replicate samples.

Samples sent to ActLab for assay were analysed by fire assay for gold and ICP for the base metals. The gold fire assay method used 30 g pulp. The sample was mixed with fire assay fluxes (borax, soda ash, silica, and litharge), with Ag added as a collector and the mixture was placed in a fire clay crucible. The mixture was then preheated to 850°C, intermediate 950°C and finish 1060°C with the entire fusion process lasting 60 minutes. The crucibles were then removed from the assay furnace and the molten slag (lighter material) was removed leaving a lead button. The lead button was then placed in a preheated cupel which absorbs the lead when cupelled at 950°C to recover the Ag (doré bead) + gold. The entire Ag doré bead was dissolved in aqua regia and the gold content was determined by AA).

For base metals, a 0.5-g sample was digested in aqua regia at 90°C in a microprocessor-controlled digestion block for 2 hours. Digested samples were diluted and analyzed by Perkin Elmer Sciex ELAN 6000, 6100 or 9000 ICP/MS.

ActLab facilities in Ancaster comply with the ISO/IEC 17025 standard which is used by testing and calibration laboratories. There are two main sections in ISO/IEC 17025 - Management Requirements and Technical Requirements. Management requirements are primarily related to the operation and effectiveness of the quality management system within the laboratory. Technical requirements address the competence of staff, methodology, test/calibration equipment and the test methods. In 1998 ActLab was one of the first labs in North America to attain this accreditation.

10.2.3 Stratmat Project Security

On-site personnel at the project collect and track samples which are then security sealed and shipped to the assay laboratory for crushing and splitting and assaying. Analytical accuracy and precision are monitored by the analysis of reagent blanks, reference material and replicate samples.

10.2.4 Stratmat Project Quality Assurance and Quality Control Programs

SRK is unaware of the QA/QC protocols used by Cominco, Noranda or Xstrata for the historical drilling. However, these companies were all major mining companies at the time that the exploration programs were carried out at the Stratmat project and SRK is of the opinion that these companies would have employed the best practices available at the time that these programs were being executed. Most companies would have utilised SRM and duplicated for drilling programs in the 1970s and 1980s. It very unlikely that any QA/QC samples would have been included before 1970.

Quality control is further assured by the use of international and in-house standards. Blind certified reference material is inserted at regular intervals into the sample sequence by Trevali personnel in order to independently assess analytical accuracy. Finally, representative blind duplicate samples are routinely forwarded to an ISO compliant third party laboratory for additional quality control.

Trevali inserted blanks, SRM and field duplicates with each sample batch dispatched to the assay laboratory. The general practice was to insert two SRM, four field duplicate and one blank with every batch of forty samples. All QA/QC samples were reviewed and monitored by Reflex Geochemistry (Reflex).

Reflex concluded that the blanks showed very little to no contamination issues. One outlier might represent a misplaced sample, or be directly in sequence with a preceding high-grade sample. The quartzite blank performed well to monitor potential Au and Ag contamination, but the base metal levels were relatively high, pointing to some possible contamination issues for both laboratories. ACME seems to perform much better than ActLabs which prompted Trevali to switch from ActLabs to ACME. Still some coincident clusters of very high Cu, Pb and Zn contents in the quartzite blank were noted at Acme (Table 18). These may indicate carry-over from preceding high-grade samples. It is recommended to verify this potential cross contamination within the individual batch reports, and rule out the possibility that the quartzite material itself has a high base-metal content.

Table 18: Blank Performance by Laboratory

Laboratory	Tests in Exceeding Acceptable Limit	% of Total Tests
ACME	67	4.67
ActLabs	118	26.58

Actlabs's quartzite blank data show major issues with copper, lead and zinc which lead Trevali to switch to ACME labs instead.

Generally, the SRM data for ACME Labs are acceptable and indicate good accuracy. ActLabs SRM failure was generally high in the 15 to 20% which contributed to Trevali switching to ACME for the remainder of the drill program.

A major negative bias (-20% to -80%) is observed for gold by aqua-regia methods, for all SRMs at both laboratories. Reflex noted that the SRMs were not certified for aqua-regia digests and that the bias didn't indicate a lab issue, but should be regarded as a warning to avoid aqua-regia for gold assaying of drill core, as it will generally underestimate the true gold grade.

Reflex also noted that Acme's method MA370 reported a relatively strong positive bias for silver, of about 10%.

Actlabs's aqua-regia AR-MS method reported a strong negative bias for copper, particularly in CDN-ME-14 (about -20%), and a minor, grade-dependent negative bias for lead.

Table 19 shows the SMR performance for the two laboratories.

Overall, the sampling precision as measured by the field repeatability showed fairly high variance, but is generally acceptable, with the exception of a few extreme values where the grades are very heterogeneous. Table 20 summarizes the field duplicate sample results.

Table 19: SRM Performance and Failure Rate by Laboratory

Laboratory	SRM Number	Test in Excess of Limits	% of Total Tests
ACME	CDN-FCM-7	16	10.88
ACME	CDN-HZ-2	0	0
ACME	CDN-ME-1201	4	2.9
ACME	CDN-ME-13	0	0
ACME	CND-ME-1306	0	0
ACME	CDN-ME-14	5	1.92
ACME	CDN-ME-17	17	5.54
ACME	CDN-ME-18	13	18.84
ActLab	CDN-FCM-7	17	21.79
ActLab	CDN-ME-1201	16	14.16
ActLab	CDN-ME-14	33	22
ActLab	CDN-ME-17	25	18.52

Table 20: Comparison of Field Duplicates with Original Assay Values

Sampling Type	Element	Tests Outside (±10% Difference) Limit	% of Total Tests
1/2 Core - Field Duplicate	Au	2	20.00
1/2 Core - Field Duplicate	Ag	1	25.00
1/2 Core - Field Duplicate	Cu	6	46.15
1/2 Core - Field Duplicate	Pb	0	0.00
1/2 Core - Field Duplicate	Zn	3	27.27
1/4 Core - Field Duplicate	Au	27	12.33
1/4 Core - Field Duplicate	Ag	4	4.82
1/4 Core - Field Duplicate	Cu	30	13.10
1/4 Core - Field Duplicate	Pb	29	14.57
1/4 Core - Field Duplicate	Zn	29	13.30

10.3 Bulk Density Data

Bulk density data are used in the model to convert the wireframe volumes into tonnes. There are 2,688 bulk density measurements for the Halfmile project and there is a total of 4,819 bulk density measurements in the Stratmat database. Of the 2,688 measurements from Halfmile, 1,396 are from the mineralized zones and 1,292 are from un-mineralized wall rock (Table 21).

Table 21: Halfmile Project Bulk Density Measurements by Zones

Zone	Count	Average Density
Upper	534	3.76
Lower	542	3.49
North	0	NA
Deep	28	4.11
South	39	3.14
Waste	1,292	2.99
Total	**2,688**	**3.37**

For Stratmat 3,483 of the 4,819 samples were from mineralized intervals. Table 22 summarizes the bulk density data by mineralized zones.

Table 22: Stratmat Project Bulk Density Measurements by Zones

Zone	Count	Average Density
Main	285	4.18
New	139	3.86
S0	0	NA
S5	110	4.25
S1 Deep	659	3.3
S1 Shallow	143	3.58
Waste	3483	2.96
Total	**4819**	**3.13**

10.4 SRK Comments

SRK has reviewed the QA/QC program implemented by Trevali and the report on the QA/QC prepared by Reflex. In our opinion, the sampling preparation, security and analytical procedures used by Trevali and the previous operators of the Halfmile and Stratmat projects are consistent with generally accepted industry best practices and are therefore adequate for the inclusion in a mineral resource estimation.

Because most of the historical drilling was carried out by senior mining companies that would have followed standard industry practices at the time of drilling, and because the more recent drilling seems to confirm the historical drilling, SRK is of the opinion that the sample preparation, security and analytical procedures are adequate for the inclusion in the resource estimation process.

11 Data Verification

11.1 Halfmile Project Data Verification

Trevali and SRK carried out a detailed verification of the assay database by comparing the digital data against copies of assay certificates (PDF files) provided by previous owners of the data. Several errors were noted in downhole survey as well as in assay data. Trevali corrected all errors that were noted and carried out a full database validation in the process. SRK validated the new data and agrees that the new database correlates well with the drill log PDF data. SRK, however, noted that none of the Texas Gulf 1955-56 drilling (98 boreholes) had drill log assay data. The assay data for these boreholes were generated from PDF of cross sections prepared by Noranda in the mid 1980s and as such couldn't be properly validated.

All of Trevali's drill data were validated against PDF assay sheets provided by the assay lab. Further verification of the Trevali drilling was provided by Reflex, an independent consultant to Trevali. SRK reviewed the reports prepared by Reflex and is satisfied of the integrity of the assay data used for the resource estimation.

11.1.1 Halfmile Project Site Visit

SRK carried out a site visit to the Halfmile project on May 27 and 28, 2016. During the site visit, SRK examined drill core drilled by Trevali and confirmed the logging and sampling procedures followed. SRK validated the relative borehole positions of all significant drilling campaigns from 1955 to 2013 and found no errors with the drill locations. All holes were within the accuracy of the handheld GPS unit used to locate them.

SRK also collected four representative samples of the massive sulphide mineralization found in core. As can be seen from Table 23, the SRK samples agree very well with the original assay values reported by Trevali.

The samples from the Halfmile project were dropped at ALS Minerals in North Vancouver (ISO 9001:2008). ALS is a reputable laboratory well recognized for its high quality. SRK is of the opinion that the ALS QA/QC standards are very acceptable.

SRK notes that all samples returned elevated arsenic values (all above 10,000 ppm). There are very few arsenic assays in the Halfmile database. Only 530 samples from the mineralized interval have been assayed for arsenic and 505 were collected from the Lower Zone.

Table 23: Comparison of SRK Sampling with Original Trevali Sampling Results

				SRK Sampling						Original Values					
Hole-ID	From	To	Sample	Au (g/t)	Ag (g/t)	As (ppm)	Cu (%)	Pb (%)	Zn (%)	Au (g/t)	Ag (g/t)	As (ppm)	Cu (%)	Pb (%)	Zn (%)
HK13-27	185	186	C048189	0.437	26.9	>10,000	0.397	1.125	4.66	0.26	33	na	0.37	1.45	4.93
HK10-04	72.5	75	C048190	1.63	58.1	>10,000	0.986	0.813	4.59	1.35	56	na	0.98	0.88	4.44
HK11-08	134	138	C048191	1.115	59	>10,000	0.57	1.51	5.94	0	43	na	0.56	1.54	4.78
HK11-07	85	89	C048192	0.679	44.3	>10,000	0.48	1.205	4.81	0.54	44	na	0.68	1.01	4.15

In addition to the independent samples collected by SRK during the site visit, Tetra Tech also collected independent from drill core during their site visit of 2011. Overall, the results of the Tetra Tech sampling results from this sampling showed a decrease of 11.71% lead, 17.61% zinc and 99.85% gold while copper and silver showed an increase of 56.76% and 25,770.97% respectively. Tetra Tech concluded that the sample set was too small to draw any significant conclusions, but that further work would be required to explain the apparent difference. Tetra Tech did note that their samples were heavily oxidized and that excessive oxidation could have affected the results of their sampling.

SRK is satisfied that the logging and sampling procedures followed by Trevali for the Halfmile project are in keeping with industry practices and acceptable for the inclusion of a mineral resource estimate.

11.2 Stratmat Project Data Verification

SRK carried out a verification of the assay database by comparing the digital data supplied by Trevali against copies of assay certificates (PDF files) provided by the assay laboratories. Further verification was provided by Reflex, an independent consultant to Trevali. SRK reviewed the reports prepared by Reflex and is satisfied of the integrity of the assay data used for the resource estimation.

11.2.1 Stratmat Project Site Visit

SRK carried out a site visit to the Stratmat project area on November 24 and 25, 2014. During the site visit, SRK examined drill core and confirmed the logging and sampling procedures followed by Trevali. In addition, SRK examined the sample handling procedures and security measures and located 15 boreholes in the field. SRK validated the relative borehole positions against data provided by Trevali and found no errors with the drill locations. All holes were within the accuracy of the handheld GPS unit used to locate them.

SRK is satisfied that the logging and sampling procedures followed by Trevali for the Stratmat projectare in keeping with industry practices and acceptable for the inclusion of a mineral resource estimate.

12 Mineral Processing and Metallurgical Testing

12.1 Introduction

Mining of lead/zinc/copper sulfide mineralization in the BMC has been active since 1964. The deposits are of three distinct geological types: (1) the Brunswick type that were mined at the Brunswick Mining and Smelting operations and the Heath Steele Mine, and is characterized by their association with pyroclastic (volcanic fragments) and sedimentary rocks; (2) the Caribou type, which is more closely associated with sedimentary rocks, that is being mined at Caribou and has been mined at Murray Brook; and (3) the Halfmile type which is hosted in phyllitic rocks (platy and normally consist of quartz, serecite, mica and chlorite). The geological setting does not appear to influence the processing of these mineralizations although it might be expected that the Halfmile type which is also characteristic of the Stratmat project would need additional reagents to limit the flotation of non-sulfide gangue.

12.2 Halfmile Project Metallurgical Testing

Noranda undertook a study of the Halfmile project in 1998 which produced results and conclusions that are summarized as follows:

"Lock cycle test results indicated that the Halfmile ore will yield total recoveries of 25.96% for copper, 89.72% for zinc, 48.56% for silver and 72.07% for lead. A lead concentrate of 46% lead and a zinc concentrate of 53% zinc are anticipated. The mineralogical studies on the Halfmile Lake ore samples showed good potential for the zinc concentrate. With a zinc concentrate containing 53% zinc and recovery of nearly 85%, the iron levels of 8%, lead levels of 2%, low copper levels and relatively low arsenic, cadmium, manganese and cobalt levels, a good quality concentrate was expected to be produced from the Halfmile Lake ore" (Noranda,1998).

Test mining of the Halfmile plant feed in 2012 which was processed over four campaigns through the Brunswick concentrator gave the overall result presented in Table 24.

This test milling included production of a bulk concentrate containing 8% of feed zinc and 5% of feed lead. There is currently only one Imperial smelter in production (in Japan) making the marketing of bulk concentrates very difficult. The flowsheet for a new mill or modification of the existing Caribou mill would have to be set up so that the metals contained in the bulk concentrate would report to separate lead and zinc concentrates with likely more loss to tails and to the "opposite" concentrates. The above results can only serve as an indicator of the metallurgy as there is no information on how representative the samples tested were of the entire mineralization body. Another factor in the value of the results was the large capacity of the Brunswick concentrator relative to the sample size which only supported short term operation and limited the time to optimize the circuit during the testing.

Table 24: Summary of Results from Test Milling of Halfmile Plant Feed at the Brunswick Concentrator

Year To Date		Assays					Distribution					Metal Contents				
Description	Dry Tonnes	Pb %	Zn %	Cu %	Ag g/t	Fe %	Pb %	Zn %	Cu %	Ag %	Fe %	Pb (t)	Zn (t)	Cu (t)	Ag (g)	Fe (t)
ORE M #6 MILL	62,781.00	1.48	4.45	0.42	41.00	28.34	45.99	46.10	47.36	46.85	53.99	929.24	2,793.38	265.89	2,596,427	17,795.26
ORE M #12 MILL	62,788.00	1.48	4.45	0.42	41.00	28.35	45.99	46.11	47.36	46.86	54.00	929.24	2,733.69	265.92	2,595,712	17,797.28
ORE M TOT ACT	62,788.00	1.48	4.45	0.42	41.00	28.35	45.99	46.11	47.36	46.86	54.00	929.24	2,793.69	265.92	2,596,712	17,797.28
ORE M TOT ACT	62,781.00	1.48	4.45	0.42	41.00	38.34	45.99	46.10	47.36	46.85	53.99	929.24	2,793.38	265.89	2,596,427	17,795.26
ORE M TOTOIFF	125,569.00	1.61	4.83	0.45	44.00	28.62	100.00	100.00	100.00	100.00	100.00	2,020.45	6,058.99	561.46	5,541,981	35,938.63
Cu Cn	1,093.15	4.50	2.74	28.02	311.00	28.95	2.65	0.79	54.55	54.55	0.88	53.53	29.91	306.25	339,549	316.51
Pb cn	1,924.99	43.79	6.12	1.03	702.00	15.72	41.72	1.94	3.55	3.55	0.84	843.02	117.00	19.92	1,351,743	302.61
Zn Cn	7,968.19	2.78	52.76	0.48	91.00	9.69	10.97	69.39	6.78	6.78	2.15	221.67	4,204.05	38.05	727,330	771.89
Bk Cn	1,069.33	9.92	44.50	1.51	222.00	9.51	5.25	7.85	2.88	2.88	0.28	106.10	475.83	16.19	237,810	101.67
TAILINGS	113.513.34	0.70	1.08	0.16	25.00	30.35	39.40	20.32	32.24	32.24	95.85	796.12	1,231.48	181.04	2,885,552	34,445.96
					TOTAL PAID RECOVERIES		**46.98**	**77.24**	**54.55**	**34.81**						

12.3 Dense Medium Separation (DMS) Test

A DMS test was carried out on a sample of Halfmile project mineralization at SGS Lakefield for Kria Resources, which was a subsidiary of Trevali. No report was issued, but the test results were used to predict that rejection of 22% of the mass of mineralization in a float product could be done with the loss of 0.39% of the metal values. Recent analysis of the data shows that there is no balance between the feed grade and the sink product. As shown in Table 25 the calculated zinc grade of the float product was not reasonable.

The probable reason is likely that there was insufficient feed sample analysed at the coarser sizes to get a representative result of the metal loss in the rejects. It seems likely that the sample was largely massive sulfide as more than 90% had a SG of more than 3.6 in the larger sizes and it was only in the fines fraction that there was any significant amount of liberated gangue that would float. For the financial analysis in the PEA, it has been estimated that 1.5% of the metal values will be lost at 22% reject for the Halfmile mineralization and 3% of metals will be lost from the Stratmat mineralization, which has more disseminated sulfides than Halfmile.

Table 25: Calculated Metal Grade from DMS Test

Size	Feed			Product			Calc Discard Grade		
	Zn (%)	Cu (%)	Au (g/t)	Zn (%)	Cu (%)	Au (g/t)	Zn (%)	Cu (%)	Au (g/t)
-75/+50mm	4.56	0.22	0.50	4.03	0.22	1.24	17.92	0.22	-18.13
-50/+37.5mm	4.32	0.26	1.48	4.29	0.24	1.88	4.46	0.34	-0.19
-37.5/+25mm	3.10	0.30	1.07	6.04	0.23	1.46	-7.98	0.56	-0.40
-25/+19mm	5.45	0.15	0.75	6.01	0.28	1.45	0.21	0.01	0.03
-19/+12.5mm	3.35	0.23	0.97	4.59	0.41	1.25	0.07	0	0.02
-12.5/+6.3mm	4.10	0.20	0.77	4.11	0.30	1.57	4.15	-0.10	-1.66
-6.3/+2mm	2.63	0.26	1.42	4.32	0.32	1.68	-1.93	0.10	0.73
-2/+1mm	3.42	0.26	1.07	4.53	0.35	1.71	0.01	0	0

12.4 Stratmat Project Metallurgical Testing

The Stratmat project is adjacent to the Heath Steele Mine site and the Boundary and N5 deposits. The Boundary and N5 deposits are in the same geological settings as the Stratmat project and have already been mined out by Noranda. No records of the metallurgy from the processing of the historical ore have been made available. There were no metallurgical studies on Stratmat mineralization up to July 2015 (SRK 2015).

Recent studies have shown that a primary grind with a P_{80} of 53 microns would be more than adequate for this mineralization. It is noted that none of this work or the data in the previous PEA (Tetra Tech 2010) provide sulfur grades in either the mineralization or concentrates so that it is not possible to follow silicate gangue recovery.

Themost representative result in this test work which was obtained with 500 g/t of sodium cyanide as zinc depressant is shown in Table 26.

The result shows good lead recovery to the lead concentrate but with high zinc and pyrite contamination probably due to the high addition rate of Cytec 241 collector (25 g/t). The zinc concentrate grade was satisfactory but the recovery low because of the large loss of zinc to the lead roughers, a loss which would be expected to be partially returned to the zinc circuit feed in the lead cleaner tails.

Table 26: Stratmat Laboratory Test Results using Sodium Cyanide as Zinc Depressant

Product	Mass		Assays		Recoveries (%)	
	Grams	%	Pb (%)	Zn (%)	Pb	Zn
Pb Conc.	120.6	12.1	14.6	8.2	83.6	16.7
Zn Conc.	136.5	13.7	0.79	32.1	5.1	74
Tailings	738.8	74.18	0.32	0.75	11,23	9.35
Calc. Head	995.9	100	2.11	5.95	100	100

12.5 Testing of Combined Halfmile/Stratmat Project Mineralizations

The provenance of the sample of 50% Halfmile, 50% Stratmat mineralization was given in the recent report from Holland and Holland Consultants (Holland, 2016). The composition of this sample and the custody chain are acceptable. However, the sample did not contain any hangingwall or footwall material which would normally be expected to be mined by normal dilution of the mineralization. It is anticipated that most of this mining dilution would be removed in the dense media separation (DMS) plant before the grinding and flotation plant and would not impact the flotation circuit.

12.5.1 Rougher Flotation

Initial testwork on the sample compared rougher recoveries at three grind sizes (P_{80} of 72, 57, and 31 microns) and the 72-micron grind was chosen for further testing. Although the lead flotation rate in the rougher was somewhat slower than at finer grinds, the contamination of the rougher lead concentrate with zinc and pyrite was lower and the zinc rougher concentrate grade was higher. The collector used in these tests was a mixture of 80% sodium isopropyl xanthate (SIPX) and 20% potassium amyl xanthate (KAX). The main determinant of grade appears to have been the pyrite flotation rate which is indicated by the iron recovery to tails, as shown in purple in Table 27. Later, a test was carried out with more sodium carbonate added to the mill to keep the pH above 9 compared to less than 8 in the earlier test and, in a second test an even coarser grind (P_{80} = 85 microns) was used. The higher pH lowered lead and zinc recoveries while increasing pyrite depression somewhat but the coarser grind resulted in much poorer pay metal recovery indicating that the 72-micron grind is close to optimal. Pyrite recovery was considerably reduced at the 85-micron grind and suggests that pyrite activation by lead and copper ions or possibly flotation of low grade galena/pyrite and sphalerite/pyrite middlings becomes excessive at the finer grinding.

Subsequent test work indicated that sodium cyanide/zinc sulfate depression of zinc in the lead rougher and scavenger combined with the use of a weaker collector combination (SIPX) (80%) and potassium ethyl xanthate (20%) gave better overall selectivity while still maintaining recoveries – test results are shown in Table 28. It is noteworthy that most of the gain was in selectivity over pyrite and, at 28.8%, there was still a very high recovery of zinc to the lead concentrate.

Reducing the collector to the lead float by 50% while increasing the depressant addition by 50% further reduced the zinc recovery to the lead concentrate to just 23% and increased pyrite rejection to tails (as indicated by iron recovery) from 68% to 71%.

Table 27: Grinding Optimization

Milling Time (min)	Stream	Mass (%)	Grade (%) Pb	Grade (%) Zn	Grade (%) Fe	Distribution (%) Pb	Distribution (%) Zn	Distribution (%) Fe
30 (P_{80} = 72.4 µm) pH from <8	Cu/Pb Ro Con	9.4	20.59	12.36	23.08	68.9	13.9	9.7
	Cu/Pb Ro Scav Con	16	3.75	14.17	31.5	21.3	27.1	22.4
	Zn Ro Con	25.2	0.59	19.38	30.87	5.2	58.3	34.5
	Tailings	49.5	0.26	0.13	15.21	4.6	0.8	33.4
40 (P_{80} = 57.0 µm) pH from <8	Cu/Pb Ro Con	10.6	19.29	14.3	21.96	61.3	18.5	11
	Cu/Pb Ro Scav Con	12.1	7	14.3	32.4	25.5	21.2	18.7
	Zn Ro Con	30.3	1.11	16.11	31.34	10.1	59.6	45.1
	Tailings	47	0.22	0.12	11.29	3.1	0.7	25.2
83 (P_{80} = 30.6 µm) pH from <8	Cu/Pb Ro Con	13.6	18.56	14.55	22.66	70	24.6	15
	Cu/Pb Ro Scav Con	9.8	6.15	13.45	32.1	16.7	16.4	15.4
	Zn Ro Con	29.3	1.29	16	29.98	10.4	58.3	42.8
	Tailings	47.2	0.22	0.12	11.64	2.9	0.7	26.8
30 (P_{80} = 72.4 µm) pH 9.2 from mill	Cu/Pb Ro Con	12.2	18.63	15.78	23.65	64	22.1	13.2
	Cu/Pb Ro Scav Con	13.4	5.93	14.18	33.78	22.4	21.9	20.8
	Zn Ro Con	21.3	1.53	22.17	30.87	9.2	54.4	30.2
	Tailings	53.1	0.29	0.26	14.7	4.4	1.6	35.8
24 (P_{80} = 85 um) pH 9.2 from mill	Cu/Pb Ro Con	9.7	20.9	15.44	22.16	61.3	18.8	9.8
	Cu/Pb Ro Scav Con	5.9	6.94	14.84	33.38	12.3	11	8.9
	Zn Ro Con	21.5	2.76	24.4	28.1	17.9	65.6	27.4
	Tailings	62.9	0.45	0.59	18.9	8.5	4.6	53.9

Table 28: Use of Sodium Cyanide and Zinc Sulfate to Depress Zinc and Pyrite

	Stream	Mass (%)	Grade (%) Pb	Grade (%) Zn	Grade (%) Cu	Grade (%) Fe	Distribution (%) Pb	Distribution (%) Zn	Distribution (%) Fe
50 g/t NaCN and 200 g/t $ZnSO_4$ to grind	Cu/Pb Ro Con	8.5	29.28	15.36	3.14	18.99	73.4	15.9	7.5
	Cu/Pb Ro Scav Con 1	3.6	9.20	18.9	0.89	29.4	9.8	8.3	5
	Cu/Pb Ro Scav Con 2	1.9	5.00	19.55	0.51	30.9	2.8	4.6	2.8
	Cu/Pb Ro + Ro Scav Con	14.1	20.78	16.85	2.2	23.3	86.1	28.8	15.3
	Zn Ro Con	16	1.26	34.88	0.18	22.12	5.9	67.7	16.5
	Tailings	69.9	0.39	0.41	0.05	21	8	3.5	68.2
50 g/t NaCN and 200 g/t $ZnSO_4$ to grind, 50% less xanthate to lead float	Cu/Pb Ro Con	8.1	29.87	13.67	2.86	19.0	72.0	13.5	6.7
	Cu/Pb Ro Scav Con 1	3.6	9.18	17.6	1.11	28.5	9.9	7.8	4.5
	Cu/Pb Ro Scav Con 2	1.1	5.74	16.2	0.96	28.5	1.8	2.1	1.3
	Cu/Pb Ro + Ro Scav Con	12.8	22.00	14.99	2.20	22.48	83.7	23.5	12.6
	Zn Ro Con	17.1	1.40	34.68	0.36	21.52	7.1	72.4	16.1
	Tailings	70.1	0.44	0.48	0.07	23.3	9.2	4.1	71.4

Sodium metabisulfite was also tested as a zinc/pyrite depressant in this series of tests but gave a result that was inferior to that with sodium cyanide/zinc sulfate. There is clearly some potential for the use of metabisulfite and further testwork with this reagent is expected to be done at the next stage of process development.

12.5.2 Cleaner Flotation

Cleaner studies were undertaken on rougher concentrate produced with a P_{80} of 72 microns in the primary grinding and the sodium cyanide zinc sulfate depressant. The collector initially was the 80% SIPX/ 20% PAX mixture used in the rougher scoping studies which proved to be excessive for lead/copper cleaning and resulted in the production of low grade concentrate (25% lead) due to a high contamination of this concentrate by sphalerite and pyrite. Use of zinc/pyrite depressant in all stages and a more selective collector was found to be required and sodium cyanide/ zinc sulfate

depressant with minimal quantities of Cytec 241, isopropyl xanthate, and ethyl xanthate in a 50%/40%/10% mixture at pH 9.5 gave the result shown in Table 29.

Because of the substantial fraction of the zinc in both the copper/lead cleaner and recleaner tails, these streams were directed to zinc rougher flotation feed. Zinc cleaning was carried out at a higher pH (to pH 11.2) with addition of minimal quantities of SIPX (80%)/KAX (20%) collector. As shown in Table 30, this procedure produced a high-grade concentrate with a good open circuit cleaner zinc recovery of 84%.

Table 29: Lead Cleaning Balance

Stream	Mass	Grade (%)			Distribution (%)		
	(%)	Pb	Zn	Fe	Pb	Zn	Fe
Cu/Pb Ro Con	12.35	19.35	13.70	19.8	82.2	21.5	11.8
Cu/Pb Clnr Con	6.56	34.22	10.97	15.2	77.2	9.1	4.8
Cu/Pb Clnr Tailings	5.79	2.49	16.80	25.0	5.0	12.3	7.0
Cu/Pb Reclnr Conc	5.2	41.40	9.25	13.2	74.4	6.1	3.3
Cu/Pb Reclnr Tailings	1.3	6.16	17.70	23.0	2.8	3.0	1.5

Table 30: Zinc Cleaning Balance

Stream	Mass	Grade (%)			Distribution (%)		
	(%)	Pb	Zn	Fe	Pb	Zn	Fe
Zn Rghr Feed	96.4	1.04	7.85	21.16	34.4	96.1	98.6
Zn Rghr Conc	23.9	2.54	29.78	22.27	20.9	90.5	25.8
Zn Rghr Tails	72.5	0.54	0.61	20.80	13.5	5.6	72.8
Zn Clnr Conc	6.3	3.34	52.78	7.37	14.5	84.2	4.5
Zn Clnr Scav	1.4	5.08	21.33	27.36	2.4	3.8	1.8
Zn Clnr Scav Tails	10.0	1.18	1.96	40.34	4.0	2.5	19.4

12.5.3 Copper/Lead Separation

A single test was carried out using sodium cyanide at a controlled REDOX potential of -430 mv versus the silver/silver chloride electrode. Only 55% of the copper in the second cleaner concentrate was depressed with this reagent scheme and, because most of the zinc and pyrite were depressed, the concentrate grade was only 6% copper. Clearly, much further development work is required for this reagent scheme to be a viable alternative to the high lime/dextrin reagent plus steaming combination that was used at Brunswick and used at other concentrators for lead/copper separation.

12.5.4 Overall Metallurgical Balance

For the design of the metallurgical flowsheet and balance, a column recleaning stage has been included for both the lead/copper and zinc circuits as the stabilizing effect of the expected high circulating load around the column will help maintain concentrate grade during periods of low feed grade. High circulating loads around columns have been observed in several zinc recleaning circuits as had been previously reported. The flowsheet that was used at Brunswick but with modification by inclusion of a column flotation cell for final cleaning has been used in the balance with the separation extrapolated from that obtained at Brunswick on mineralization with a similar copper head grade.

The summary from the material balance projected from the test work is shown in Table 31. The level of confidence in the balance is considered to be appropriate for a PEA level of study except for the

copper lead separation but more laboratory testwork followed by a mini pilot plant or pilot plant confirmation of the flowsheet and reagent conditions will be required to attain a level of confidence necessary for a prefeasibility study.

The flowsheet includes the use of column flotation as a third and final cleaning stage in all three metal circuits. Columns have become well established in this role over the past 25 years and combine the advantages of efficient froth washing with the ability to take high circulating loads which, when used appropriately, reduces the fluctuations in final concentrate grade.

Table 31: Summary of the Projected Material Balance for the Halfmile/Stratmat Mill

	kt/a	Wt%	Assays				Distribution			
			Zn (%)	Cu (%)	Pb (%)	Ag(g/t)	Zn (%)	Cu (%)	Pb (%)	Ag (%)
Head	1,120	100	6.99	0.25	2.39	41				
Zinc Con	133.6	11.9	50.0	0.21	2.53	70	**85.3**	10.0	12.6	20.5
Copper Con	5.6	0.5	3.83	20.0	9.50	150	0.3	**40.1**	2.0	**1.8**
Lead Con	38.5	3.4	8.93	1.32	45.20	696	4.4	18.1	**65.0**	**58.8**
Final Tails	942.7	84.1	0.84	0.09	0.58	9	10.1	31.8	20.4	18.9

12.6 Future Testwork

12.6.1 DMS Testing

The inclusion of DMS on the both the Halfmile and Stratmat RoM material will require further testing of the mineralization from both projects. These samples should be representative of the expected mine production and have representative material from the expected dilution derived from gangue inclusions within the projects as well as hangingwall and footwall gangue. A carefully selected sample with material in all particle sizes expected in the -65 mm to +3 mm range will be required and will be analyzed for sulfur to ensure that it is representative of the mineralization based on its sulfide content.

12.6.2 Flotation Testing

For the final design of the flotation circuit, further laboratory test work is required with representative sample material from both projects that has been upgraded by DMS. Examining the liberation on the lead/copper concentrate will also be necessary to determine if regrinding of this concentrate is necessary for copper-lead separation. Test work should be done to examine the conditions necessary for copper/lead separation with the controlled potential reagent scheme and the use of lime/dextrin/steaming.

13 Mineral Resource Estimates

13.1 Introduction

The Mineral Resource Statements presented herein represent the second mineral resource evaluation prepared for the Halfmile-Stratmat integrated project in accordance with the NI 43-101.

The resource estimation work was completed by Dr. Gilles Arseneau, P.Geo. (APEGBC), an appropriate independent QP as defined in NI 43-101. The effective date of the Halfmile project mineral resource statement is June 23, 2016, and the effective date of the Stratmat project mineral resource statement is May 15, 2015.

This section describes the resource estimation methodology and summarizes the key assumptions considered by SRK. In the opinion of SRK, the mineral resource evaluation reported herein is a reasonable representation of the silver-lead-zinc mineral resources found in the Halfmile-Stratmat integrated project at the current level of sampling. The mineral resources were estimated in conformity with generally accepted CIM "Estimation of Mineral Resource and Mineral Reserves Best Practices" guidelines and are reported in accordance with the NI 43-101. Mineral resources are not mineral reserves and do not have demonstrated economic viability. There is no certainty all or any part of the mineral resource will be converted into mineral reserve.

The databases used to estimate the Halfmile-Stratmat integrated project mineral resources were audited by SRK. SRK is of the opinion the current drilling information is sufficiently reliable to interpret with confidence the boundaries for VMS mineralization and the assay data are sufficiently reliable to support mineral resource estimation.

Mineral resources were estimated with GEOVIA GEMS (version 6.6). Leapfrog® software was used to construct the geological solids. GEOVIA GEMS was used to prepare assay data for geostatistical analysis, construct the block model, estimate metal grades and tabulate mineral resources. Isaaks & Co.'s SAGE2001™ was used for geostatistical analysis and variography.

13.2 Mineral Resource Estimation Procedures

The resource evaluation methodology involved the following procedures:

- Database compilation and verification.
- Construction of wireframe models for the boundaries of the VMS mineralization.
- Definition of resource domains.
- Data conditioning (compositing and capping) for geostatistical analysis and variography.
- Block modelling and grade interpolation.
- Resource classification and validation.
- Assessment of "reasonable prospects for economic extraction" and selection of appropriate cut-off grades.
- Preparation of the Mineral Resource Statement.

13.3 Halfmile Project Mineral Resource Database

The resource borehole database used for the Halfmile projectcontains 395 diamond boreholes. Of these only 317 boreholes are within the immediate area covering the mineral resources presented in this report. The majority of the boreholes were drilled by Conwest in the mid-1950s and by Noranda in the 1980s. The entire Halfmile borehole database contains 8,978 records in the assay table; 3,843 of these are within the mineralized intervals and were used to prepare the mineral resource estimate presented in this report. All samples were assayed for copper, lead and zinc but gold and silver were only selectively assayed, as such, the database contains only 2,410 gold assays and 3,487 silver assays.

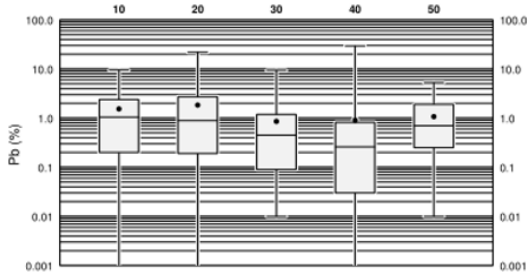
Figure 16 summarizes the assay statistic for lead, zinc, copper, silver and gold for each of the mineralized zones. As can be seen, the Upper and Lower zones have very similar lead and zinc average grades. Silver seems low in the North zone and gold is, apart from the Upper zone, generally low in all other mineralized zones.

13.4 Stratmat Project Resource Database

The resource borehole database used for the Stratmat project contains 640 diamond boreholes. Of these only 339 boreholes are within the immediate area covering the mineral resources presented in this report. The majority of the boreholes were drilled by Noranda and Xstrata, the former owners of the Stratmat project. The entire Stratmat borehole database contains 16,489 records in the assay table; 3,493 of these are within the mineralized intervals and were used to prepare the mineral resource estimate presented in this report.

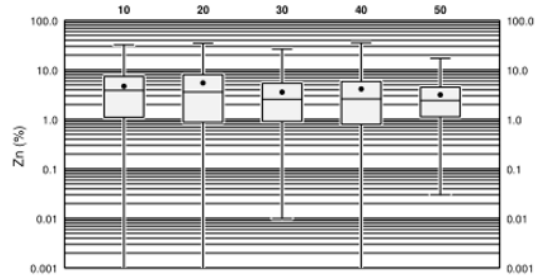
Figure 17 summarizes the assay statistic for lead, zinc, copper, silver and gold for each of the mineralized zones. As can be seen, the Main, S0 and S5 zones have very similar lead and zinc average grades. The New zone has the lowest lead and zinc average grade but the highest average copper grade of all the mineralized zones discovered to date at Stratmat. Silver and gold grades are very similar in all zones with the New zone displaying a slightly lower average silver grade than the other zones. Overall, the S1 Zone has the highest average grades for all metals except for gold and copper in the New zone. The gold content is generally very low for all zones at less than 0.5 g/t.

Halfmile Lake Lead Assays



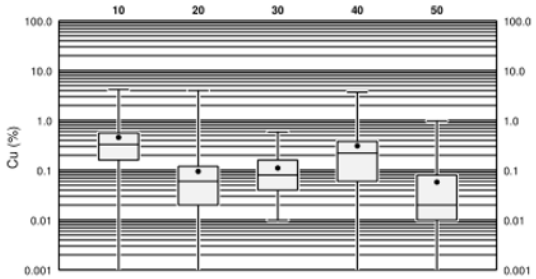
	10	20	30	40	50	
Number of data	978	2090	291	379	105	Number of data
Mean	1.542	1.846	0.86	0.909	1.075	Mean
Maximum	9.5	21.84	9.38	29.4	5.25	Maximum
Upper quartile	2.4	2.72	1.19	0.82	1.9	Upper quartile
Median	1.05	0.89	0.45	0.26	0.7	Median
Lower quartile	0.2	0.19	0.09	0.03	0.25	Lower quartile
Minimum	0.0	0.0	0.01	0.0	0.01	Minimum
Variance	2.658	5.589	1.188	5.166	1.115	Variance
Std. Dev.	1.63	2.364	1.09	2.273	1.056	Std. Dev.
CV	1.057	1.281	1.267	2.5	0.982	CV

Halfmile Lake Zinc Assays



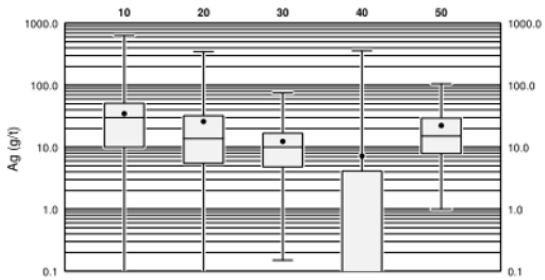
	10	20	30	40	50	
Number of data	978	2090	291	379	105	Number of data
Mean	4.701	5.487	3.569	4.134	3.154	Mean
Maximum	32.0	34.72	26.3	35.4	17.2	Maximum
Upper quartile	7.4	8.06	5.38	5.86	4.48	Upper quartile
Median	3.86	3.6	2.55	2.6	2.42	Median
Lower quartile	1.11	0.88	0.92	0.8	1.13	Lower quartile
Minimum	0.0	0.0	0.01	0.0	0.03	Minimum
Variance	18.361	32.869	13.593	21.158	8.949	Variance
Std. Dev.	4.285	5.733	3.687	4.6	2.991	Std. Dev.
CV	0.911	1.045	1.033	1.113	0.949	CV

Halfmile Lake Copper Assays



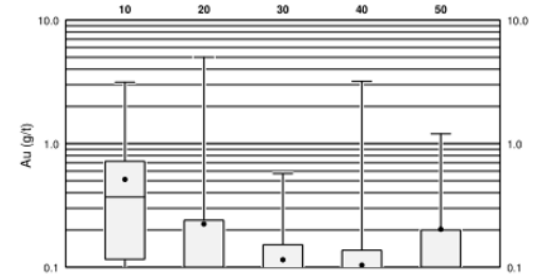
	10	20	30	40	50	
Number of data	978	2090	291	379	105	Number of data
Mean	0.457	0.095	0.111	0.31	0.058	Mean
Maximum	4.15	4.0	0.59	3.7	0.98	Maximum
Upper quartile	0.56	0.12	0.16	0.38	0.08	Upper quartile
Median	0.33	0.06	0.08	0.22	0.02	Median
Lower quartile	0.16	0.02	0.04	0.06	0.01	Lower quartile
Minimum	0.0	0.0	0.01	0.0	0.0	Minimum
Variance	0.246	0.03	0.01	0.177	0.012	Variance
Std. Dev.	0.496	0.173	0.099	0.421	0.11	Std. Dev.
CV	1.084	1.824	0.895	1.359	1.892	CV

Halfmile Lake Silver Assays



	10	20	30	40	50	
Number of data	685	2077	291	321	105	Number of data
Mean	34.737	25.938	12.381	7.167	22.364	Mean
Maximum	630.0	345.56	75.1	358.93	105.0	Maximum
Upper quartile	51.0	32.225	16.8	4.114	29.5	Upper quartile
Median	30.0	13.713	10.0	0.003	15.084	Median
Lower quartile	10.0	5.485	4.8	0.0	7.885	Lower quartile
Minimum	0.0	0.0	0.15	0.0	1.0	Minimum
Variance	1370.69	1209.81	120.297	751.456	477.619	Variance
Std. Dev.	37.023	34.782	10.968	27.413	21.854	Std. Dev.
CV	1.066	1.341	0.886	3.825	0.977	CV

Halfmile Lake Gold Assays

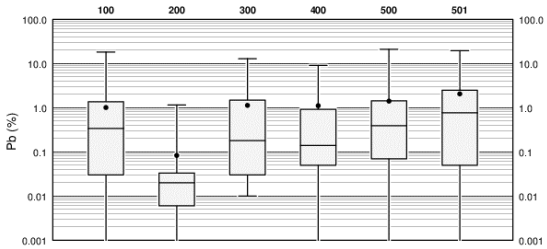


	10	20	30	40	50	
Number of data	541	1244	184	336	105	Number of data
Mean	0.514	0.224	0.115	0.104	0.203	Mean
Maximum	3.14	5.0	0.572	3.188	1.2	Maximum
Upper quartile	0.719	0.24	0.152	0.137	0.2	Upper quartile
Median	0.37	0.1	0.095	0.02	0.1	Median
Lower quartile	0.116	0.069	0.05	0.005	0.069	Lower quartile
Minimum	0.0	0.0	0.0	0.0	0.003	Minimum
Variance	0.257	0.156	0.008	0.049	0.064	Variance
Std. Dev.	0.507	0.395	0.091	0.222	0.253	Std. Dev.
CV	0.987	1.761	0.796	2.131	1.248	CV

Figure 16: Boxplots of Assay Values for Halfmile Project

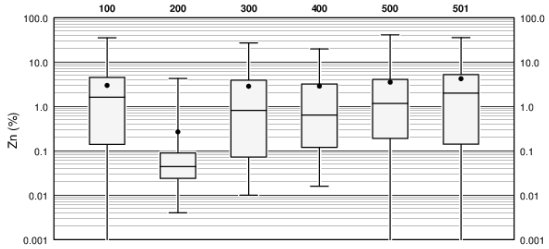
Note: 10 = Upper zone; 20 = Lower zone; 30 = Deep zone; 40 = North zone and 50 = South zone

Stratmat Lead Assay



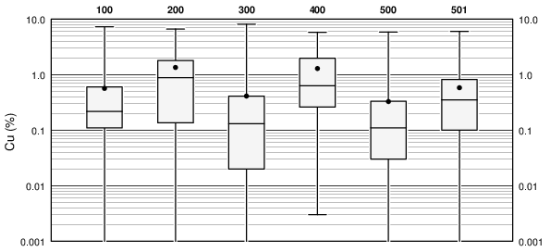
	100	200	300	400	500	501	
Number of data	768	128	210	134	1814	439	Number of data
Mean	1.008	0.083	1.129	1.109	1.407	2.052	Mean
Maximum	18.2	1.15	12.82	9.04	20.98	19.44	Maximum
Upper quartile	1.36	0.033	1.49	0.92	1.43	2.49	Upper quartile
Median	0.34	0.02	0.18	0.14	0.39	0.77	Median
Lower quartile	0.03	0.006	0.03	0.05	0.07	0.05	Lower quartile
Minimum	0.0	0.0	0.01	0.0	0.0	0.0	Minimum
Variance	3.505	0.052	3.995	3.989	6.573	10.346	Variance
Std. Dev.	1.872	0.228	1.999	1.997	2.564	3.216	Std. Dev.
CV	1.858	2.769	1.77	1.801	1.822	1.568	CV

Stratmat Zinc Assay



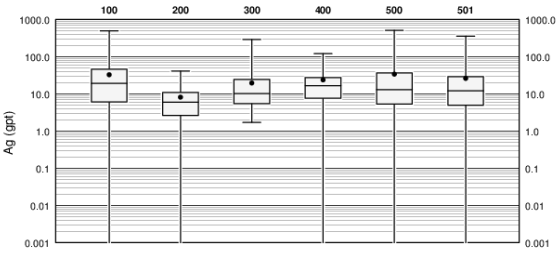
	100	200	300	400	500	501	
Number of data	768	128	210	134	1814	439	Number of data
Mean	2.98	0.268	2.85	2.869	3.52	4.221	Mean
Maximum	35.0	4.27	26.85	19.79	40.86	35.52	Maximum
Upper quartile	4.53	0.09	3.9	3.2	4.05	5.22	Upper quartile
Median	1.61	0.044	0.81	0.64	1.16	2.0	Median
Lower quartile	0.14	0.024	0.072	0.12	0.19	0.142	Lower quartile
Minimum	0.0	0.004	0.01	0.016	0.0	0.0	Minimum
Variance	17.694	0.572	20.756	21.259	32.071	40.298	Variance
Std. Dev.	4.206	0.756	4.556	4.611	5.663	6.348	Std. Dev.
CV	1.412	2.825	1.598	1.607	1.609	1.504	CV

Stratmat Copper Assay



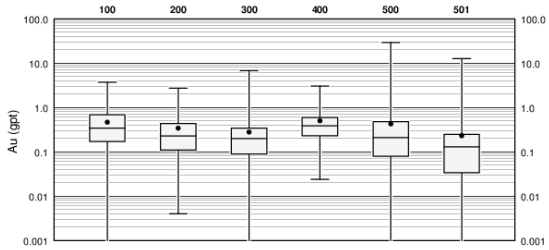
	100	200	300	400	500	501	
Number of data	768	128	210	134	1814	439	Number of data
Mean	0.565	1.346	0.411	1.287	0.327	0.581	Mean
Maximum	7.25	6.633	8.08	5.794	5.82	6.0	Maximum
Upper quartile	0.6	1.796	0.41	1.972	0.332	0.814	Upper quartile
Median	0.218	0.882	0.13	0.628	0.11	0.35	Median
Lower quartile	0.11	0.136	0.02	0.261	0.03	0.1	Lower quartile
Minimum	0.0	0.0	0.0	0.003	0.0	0.0	Minimum
Variance	0.802	2.411	0.638	2.121	0.347	0.469	Variance
Std. Dev.	0.895	1.553	0.799	1.456	0.589	0.685	Std. Dev.
CV	1.585	1.154	1.944	1.132	1.799	1.178	CV

Stratmat Silver Assay



	100	200	300	400	500	501	
Number of data	768	128	210	134	1814	439	Number of data
Mean	32.541	8.109	19.523	23.711	33.712	25.98	Mean
Maximum	495.0	40.6	287.27	119.5	507.34	355.89	Maximum
Upper quartile	45.94	10.9	24.381	27.2	36.68	29.14	Upper quartile
Median	19.1	5.9	10.12	16.5	13.0	12.0	Median
Lower quartile	6.0	2.6	5.48	7.54	5.3	4.9	Lower quartile
Minimum	0.0	0.0	1.71	0.0	0.0	0.0	Minimum
Variance	2099.45	68.256	739.515	608.264	2938.21	1475.54	Variance
Std. Dev.	45.82	8.262	27.194	24.663	54.205	38.413	Std. Dev.
CV	1.408	1.019	1.393	1.04	1.608	1.479	CV

Stratmat Gold Assay



	100	200	300	400	500	501	
Number of data	768	128	210	134	1814	439	Number of data
Mean	0.468	0.343	0.28	0.503	0.427	0.231	Mean
Maximum	3.74	2.736	6.8	3.048	29.412	12.68	Maximum
Upper quartile	0.686	0.438	0.343	0.594	0.48	0.247	Upper quartile
Median	0.343	0.227	0.2	0.389	0.21	0.13	Median
Lower quartile	0.171	0.11	0.09	0.23	0.079	0.034	Lower quartile
Minimum	0.0	0.004	0.0	0.024	0.0	0.0	Minimum
Variance	0.196	0.141	0.264	0.199	1.039	0.449	Variance
Std. Dev.	0.443	0.375	0.514	0.446	1.019	0.67	Std. Dev.
CV	0.946	1.093	1.836	0.887	2.387	2.906	CV

Figure 17: Boxplots of Assay Values for Stratmat Project

100 = Main Zone; 200 = New zone; 300 = S0 Zone; 400 = S5 Zone; 500 = S1 Deep zone; 501 = S1 Shallow zone

13.5 Halfmile Project Solid Body Modelling

Wireframe construction of the mineralization at Halfmile was carried out by Trevali using Leapfrog™ Geo Version 3.1 (Figure 18). SRK examined and validated the 3-D wireframes in Gems and accepted the solid models as a good representation of the sulphide mineralization at Halfmile given the current sampling level. SRK is of the opinion that the solid models agree well with the drill logs, the models seem to respect the geology and offer a fair representation of the geology based on the current level of sampling.

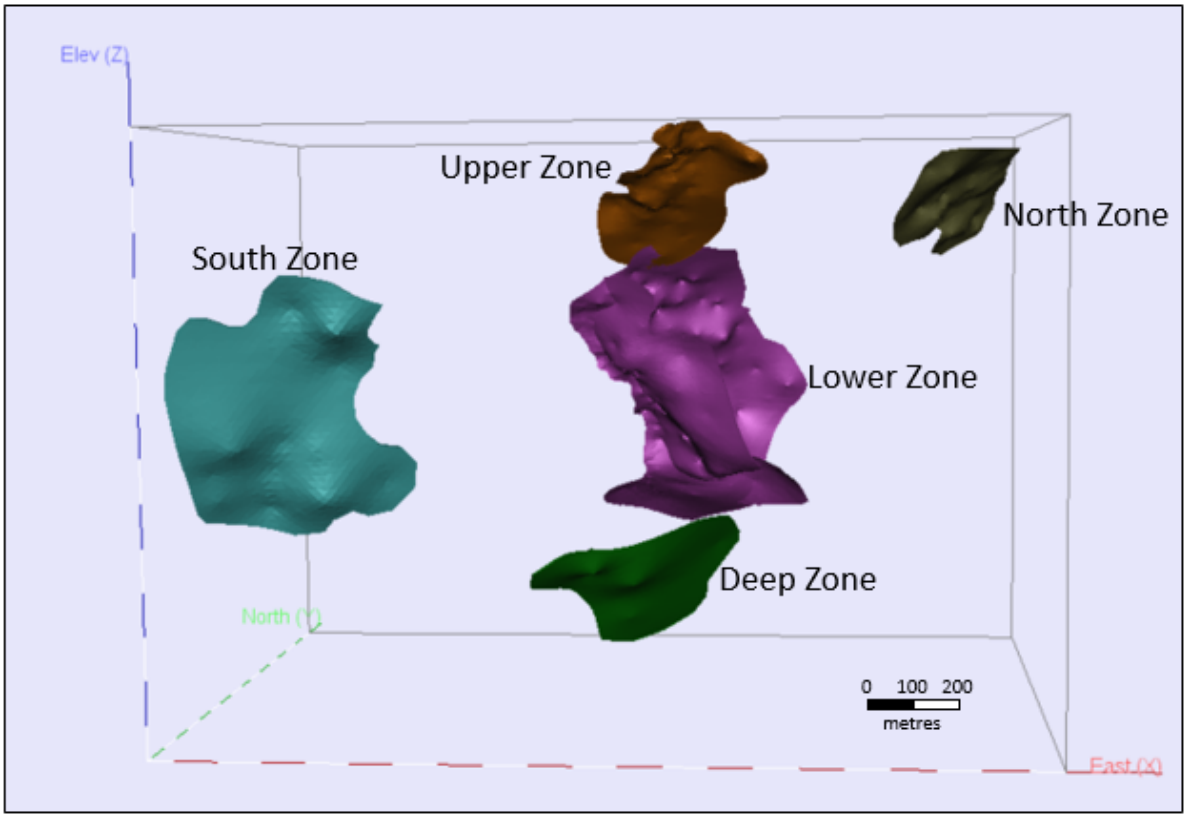


Figure 18: Three Dimensional Representation of Halfmile Project Mineralized Zones
Source: SRK (2016)

13.6 Stratmat Project Solid Body Modelling

Wireframe construction of the mineralization at Stratmat was carried out by Trevali using Leapfrog™ Geo Version 2.0 (Figure 19). SRK examined and validated the 3-D wireframes in Gems and accepted the solid models as a good representation of the sulphide mineralization at Stratmat. SRK is of the opinion that the solid models agree well with the drill logs, the models seem to respect the geology and offer a fair representation of the geology based on the current level of sampling.

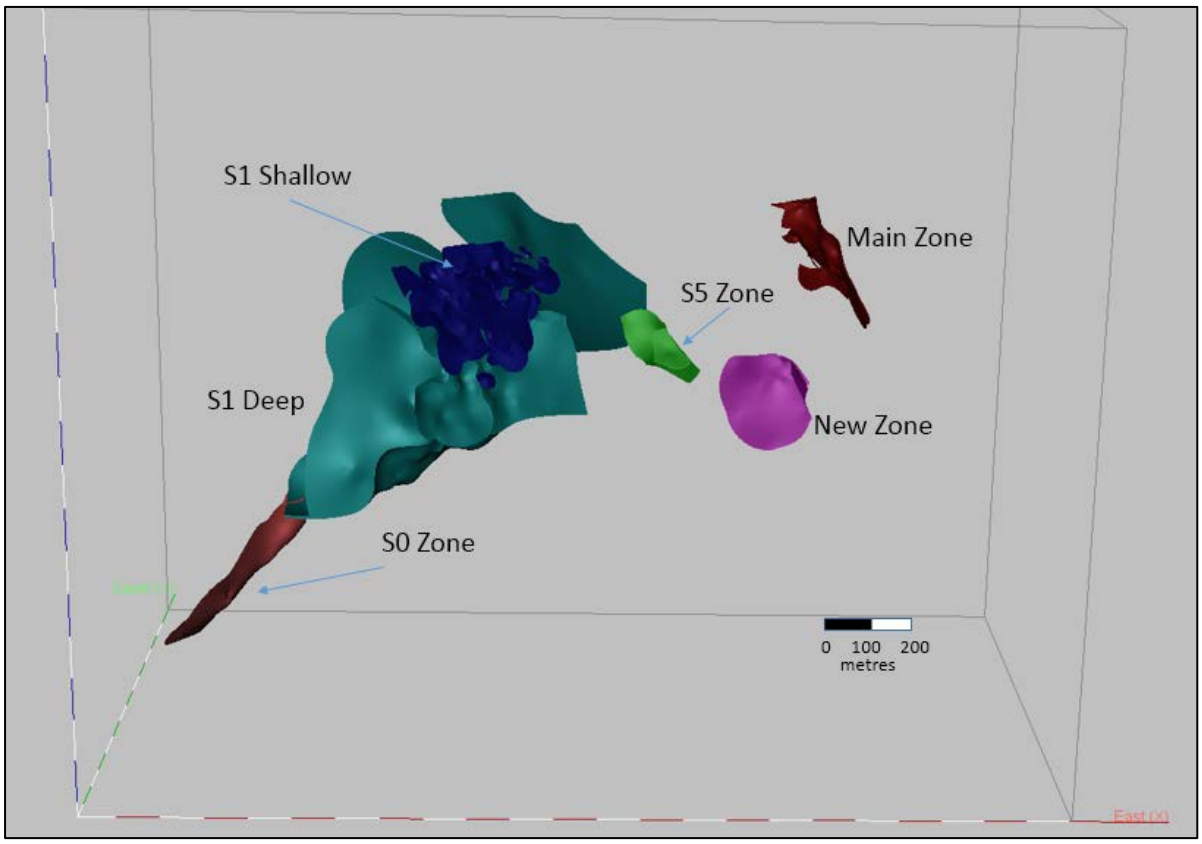


Figure 19: Three Dimensional Representation of Stratmat Project Mineralized Zones
Source; SRK (2015)

13.7 Halfmile Project Compositing

The purpose of compositing assay data is to assure equal weighting of assay values for resource estimation. SRK examined the Halfmile assay interval and noted that the majority of the assays (93%) were less or equal to 2.0 m in length and about 70% of the assay intervals were less or equal to 1.5. For this reason, SRK selected a 2.0 m composite length. SRK also noted that there didn't seem to be a correlation between assay length and average grades (Figure 20). For this reason, SRK decided to cap the assay data prior to compositing. The compositing process generated 2,462 composites for lead, zinc and copper but only 2,090 for silver and 1,321 for gold as intervals that were un-assayed for gold and silver were ignored by SRK. SRK believes that inserting zero assay data for the un-sampled intervals would adversely affect the composite population and not be representative of the true gold and silver content of the deposit. All composite lengths that were less than 1.0 m were added to the previous composite length to assure that all composited data were between 1.0 and 3.0 with the majority of composites being 2.0 m in length.

13.8 Stratmat Project Compositing

SRK examined the Stratmat assay interval and noted that the majority of the assays (80%) were less than 1.5 m in length and about 43% of the assay intervals were 1 m or less. For this reason, SRK selected a 1.5 m composite length. SRK also noted that the shorter assay intervals seemed to be associated with higher average grades (Figure 21). For this reason, SRK decided to composite the

assay data prior to evaluating the outliers for possible capping. The compositing process generated 3,142 composites within the mineralized zones. All composite lengths that were less than 0.2 m were excluded from the resource estimation process leaving 3,072 composites used for the estimation.

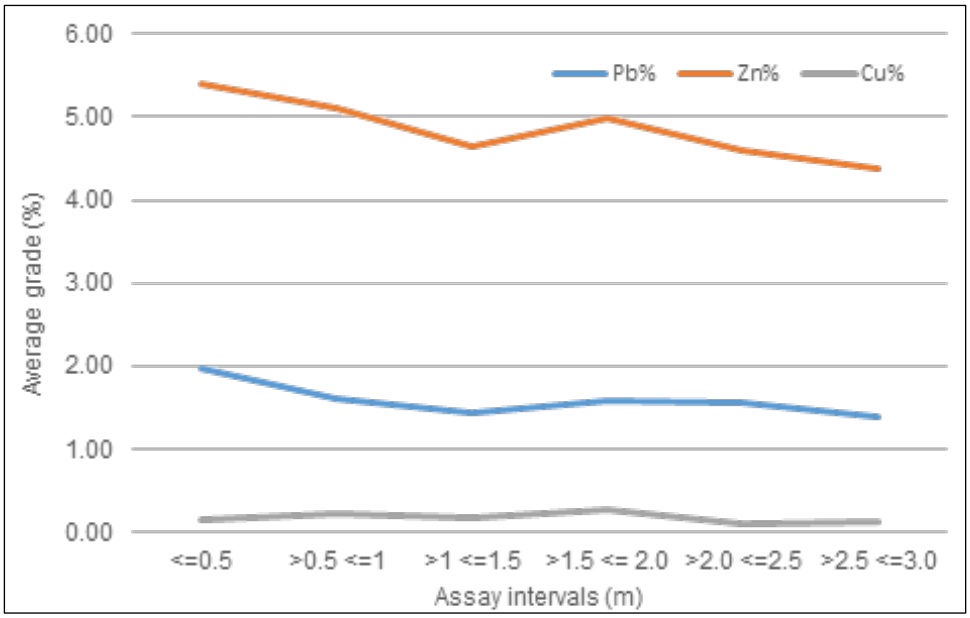


Figure 20: Comparison of Assay Length and Average Lead, Copper and Zinc Grades for Halfmile Project

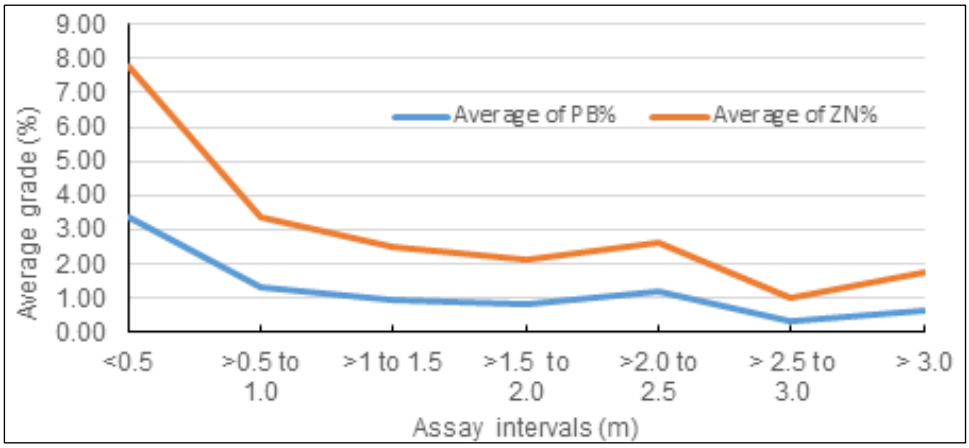


Figure 21: Comparison of Assay Length and Average Lead and Zinc Grades for Stratmat Project

13.9 Halfmile Project Evaluation of Outliers

Block grade estimates may be unduly affected by high grade outliers. Therefore, assay data were evaluated for high grade outliers. The outlier analysis was carried out on assay data, because most of the data were from the same mineralized horizon (Upper/Lower/Deep zones). SRK grouped all the assays together for the determination of outlier evaluation. Outliers were evaluated by comparing cumulative frequency plots with results from decile analysis for each of the six mineralized zones

separately. Based on the analysis, SRK decided to cap some of the composites as outlined in Table 32.

Table 32: Halfmile Project Capping Levels

Metal	Cap Level	No Capped	Metal Loss (%)
Cu (%)	2.5	19	1.6
Pb (%)	15	6	0.5
Zn (%)	30	5	0.1
Au (g/t)	2	23	3.4
Ag (g/t)	250	7	0.8

13.10 Stratmat Project Evaluation of Outliers

The Stratmat outlier analysis was carried out on 1.5 m composited assay data. Outliers were evaluated by comparing cumulative frequency plots with results from decile analysis for each of the six mineralized zones separately. Based on the analysis, SRK decided to cap some of the composites as outlined in Table 33.

Table 33: Stratmat Project Capping Level

Zone	Pb (%)	Zn (%)	Cu (%)	Ag g/t	Au g/t
Main	6	20	5	200	2
New	NC	NC	NC	NC	NC
S0	6	12	NC	90	2
S5	6	15	NC	100	NC
S1 Deep	NC	20	NC	225	10
S1 Shallow	15	25	NC	200	3

Note: NC = No capping

13.11 Halfmile Project Statistical Analysis and Variography

SRK evaluated the composited assay data with Sage 2001 to determine if a robust variogram could be generated from the mineralization. SRK was unable to construct reasonable variograms from the composited data. SRK believes that the complex folding of the Lower zone and sparse data in the other mineralized units prevented any robust variography. For this reason, SRK opted to estimate the mineral resource for the Halfmile projectusing inverse distance weighted to the second power (ID^2).

13.12 Stratmat Project Statistical Analysis and Variography

Similarly, SRK evaluated the composited assay data for the Stratmat project with Sage 2001. While reasonable correlograms could be constructed from the composited assays for the Main and S1 Zones, the data were too sparse for the New, S0 and S5 zones. The complex folding within the S1 Deep zone (Figure 22) complicated variogram analysis so only two variograms were generated, one for zinc and one for gold and silver (Table 34). All other zones were estimated usingID^2 because variograms couldn't be generated for the available data.

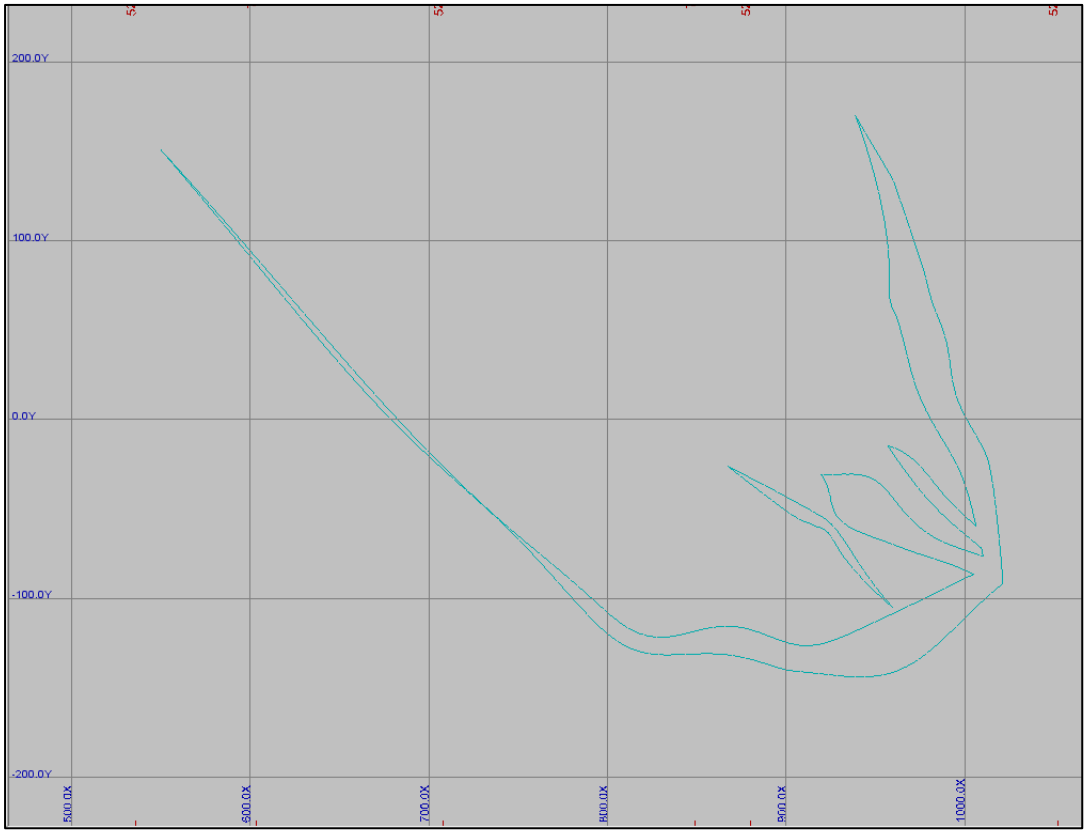


Figure 22: Section View of S1 Deep Zone Looking Northeast (Note: Grid is 100 x 100 m)
Source: SRK (2015)

Table 34: Correlogram Parameters used for Ordinary Kriging of Main and S1 Zones

Domains	Metal	Model Type	Nugget (C_0)	C_1 & C_2	Rotation		Range			
					(Z)	(Y)	(Z)	Rot X	Rot Y	Rot Z
Main	Ag	Exponential	0.15	0.85	3	-52	11	99	48	32
	Au	Exponential	0.18	0.18	0	-30	-21	10	71	48
				0.604	0	-30	-21	37	32	53
	Cu-Zn	Exponential	0.1	0.685	35	76	38	12	79	12
				0.127	35	76	38	27	52	160
	Pb	Exponential	0.2	0.674	84	-24	3	8	12	18
				0.034	84	-24	3	11	6	24
S1Y	Ag-Au	Exponential	0.30	0.243	16	-44	-53	14	140	5
				0.436	16	-44	-53	41	160	32
	Cu-Pb-Zn	Exponential	0.20	0.428	-90	57	67	14	12	5
				0.349	-90	57	67	14	113	29

13.13 Halfmile Project Block Model and Grade Estimation

Mineral resource estimation was completed within all of the mineralized zones with block model geometry and extents as presented in Table 35. As discussed in other sections, resource estimation methodology was based on the following:

- Assay data were composited to 2.0 m.
- Estimation domains were treated as hard boundaries, preventing sharing the composites across the boundaries with the exception of the Upper and Lower zones which were treated as soft boundaries.
- Inverse distance weighting was used to estimate all of the Halfmile mineralized zones.

The selection of the search radii and rotations of search ellipsoids were guided by the geometry of the mineralized veins and by the average borehole spacing as summarized in (Table 36). Because of the complex folding pattern of the Lower zone, the zone was divided into three discrete sub-domains for the estimation: Upper limb, Lower limb and Hinge sub-domain. Each sub-domain used separate search ellipse orientations.

In addition, the search radii were established to estimate a large portion of the blocks within the modelled area with limited extrapolation. The parameters were refined by conducting repeated test resource estimates and reviewing the results as a series of plan views and sections.

Table 35: Block Model Extents and Dimensions

Description	Easting (X)	Northing (Y)	Elevation (Z)
Block Model Origin (Lower left corner)	701,200	5,242,475	-900
Block Dimension	5	5	5
Number of Blocks	474	360	300

Table 36: Search Ellipse Orientation and Dimension

Zone	Ellipse Orientation (GEOVIA GEMS Convention)			Pass 1 Dimensions			Pass 2 Dimensions			Pass 3 Dimensions		
	Z	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
Upper	90	-55	5	20	50	70	40	100	140			
Lower - Upper Limb	90	-45	23	20	50	70	40	100	140			
Lower- Lower Limb	90	-25	-30	20	50	70	40	100	140			
Lower- Hinge	-12	60	55	70	40	50	140	80	100			
Deep	90	-55	22	20	50	70	40	100	140			
North	-40	46	0	20	50	70	40	100	140			
South	90	-34	22	20	50	70	40	100	140			
All Zones	90	-35	-30							60	60	150

Blocks were interpolated in three successive passes. Successive passes interpolated a block grade if the block had not been interpolated by the previous pass. Table 37 summarizes the sample selections used for each individual interpolation.

Table 37: Sample Selection Criteria for Block Estimation

Pass	Minimum Number of Composites	Maximum Number of Composites	Maximum Number of Composite per Hole
1	4	8	3
2	4	12	3
3	2	12	No limit

SRK evaluated the correlation of grade against density to determine if bulk density weighting should be considered, however, while there seems to be some correlation between grade and density (0.58), no equation could be derived because of the wide scatter of density at lower grade ranges (Figure 23). SRK is of the opinion that if iron assays were available that perhaps a better correlation could be derived and possibly density weighting could be considered for future estimation.

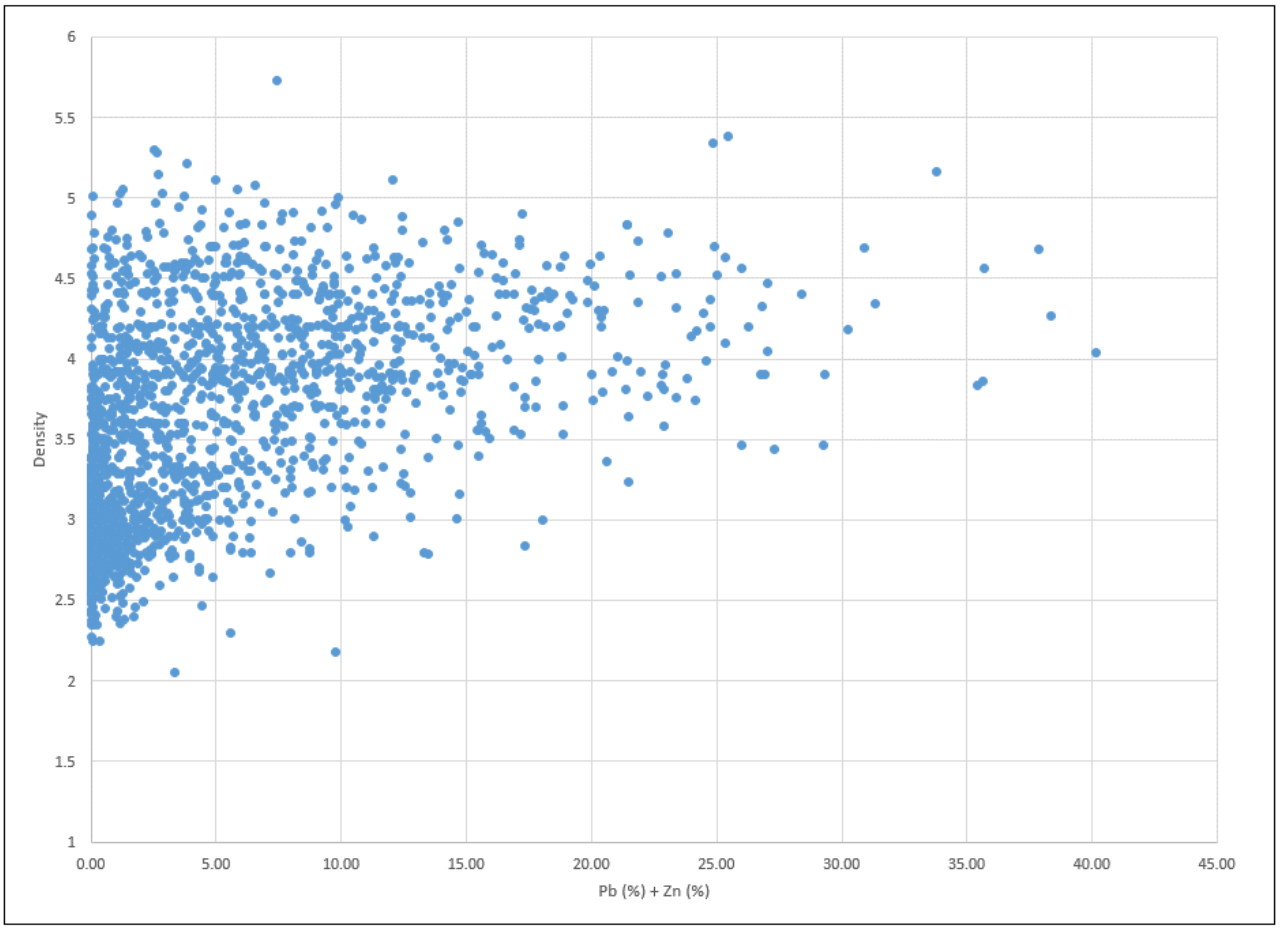


Figure 23: Correlation Between Density and Lead plus Zinc Content in Mineralized Zones for Halfmile Project

13.14 Stratmat Project Block Model and Grade Estimation

Mineral resource estimation was completed within all of the mineralized zones with block model geometry and extents as presented in Table 38. As discussed in other sections, resource estimation methodology was based on the following:

- Assay data were composited to 1.5 m.
- Estimation domains were treated as hard boundaries, preventing sharing the composites across the boundaries.
- Grades were weighted with density where data were sufficient to support density weighting, the New, S1 and S5 zones.
- Ordinary kriging was used to estimate the Main and S1 zones and the New, S0 and S5 zones were estimated using ID^2.

The selection of the search radii and rotations of search ellipsoids were guided by the geometry of the mineralized veins, by the average borehole spacing, by the modelled ranges of continuity. The selection modelled directions of best continuities from the correlograms defined for the Main and S1 zones and is as summarized in (Table 39). In addition, the search radii were established to estimate a large portion of the blocks within the modelled area with limited extrapolation. The parameters were refined by conducting repeated test resource estimates and reviewing the results as a series of plan views and sections.

Table 38: Block Model Extents and Dimensions

Description	Easting (X)	Northing (Y)	Elevation (Z)
Block Model Origin (Lower left corner)	717,000	5,243,380	-600
Block Dimension	5	5	5
Number of Blocks	400	324	200

Table 39: Search Ellipse Orientation and Dimension

Zone	Ellipse Orientation (Gemcom Convention)			Pass 1 Dimensions			Pass 2 Dimensions			Pass 3 Dimensions		
	Z	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
Main	60	86	46	15	79	36	25	130	90	8	15	15
New	20	90	-10	54	5	23	110	15	48	15	5	15
S0	54	54	24	30	15	90	60	30	120	15	5	15
S1 Shallow	-60	-38	0	10	52	52	45	110	110	5	15	15
S1 Deep	-60	-38	0	10	52	52	45	110	110	5	15	15
S5	20	-45	0	30	12	60	60	23	90	15	5	15

Blocks were interpolated in three successive passes. Successive passes interpolated a block grade if the block had not been interpolated by the previous pass. Table 40 summarizes the sample selections used for each individual interpolation.

Table 40: Sample Selection Criteria for Block Estimation

Pass	Minimum Number of Composites	Maximum Number of Composites	Maximum Number of Composite per Hole
1	3	12	2
2	3	12	2
3	3	12	12

SRK evaluated the correlation of grade against density to determine if bulk density weighting should be considered. SRK noted a definite positive correlation of density with increasing total metal content (Pb + Zn + Fe) (Figure 24). For this reason, SRK decided to weight the composited data for the New, S0 and S1 zones where sufficient bulk density data were available. The Main and S0 zones contained insufficient bulk density data to warrant density weighting. Because no density data existed for the S0 Zone, SRK used the average of all mineralized density data (3.23 t/m^3) to model this zone.

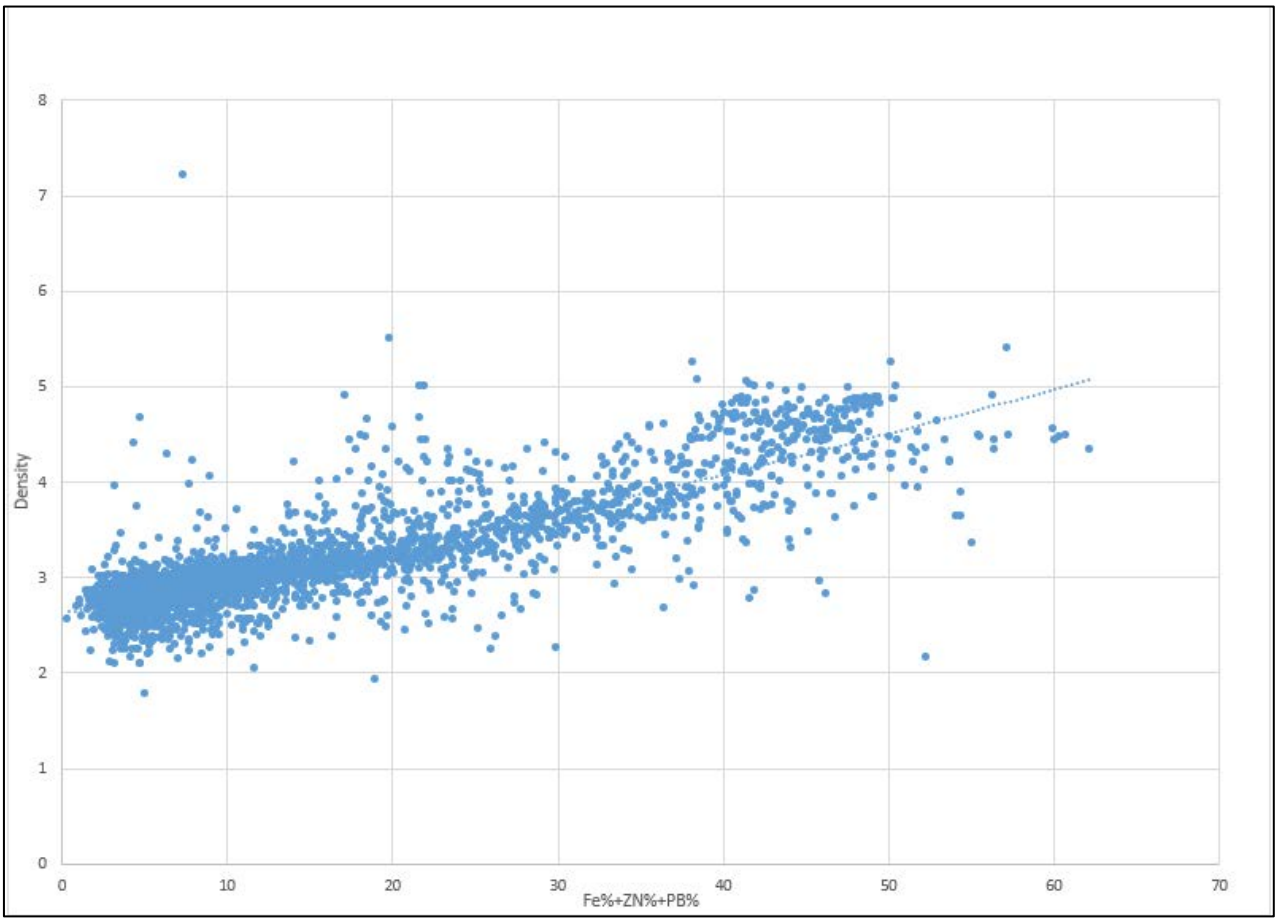


Figure 24: Correlation Between Bulk Density and Total Metal Content for all Mineralized Samples

13.15 Model Validation and Sensitivity

The zones were validated by completing a series of visual inspections and by:

- Comparison of local "well-informed" block grades with composites contained within those blocks.
- Comparison of average assay grades with average block estimates along different directions - swath plots.
- Visual comparisons

The results for zinc and lead are presented below. Visual inspection was conducted by locally comparing composite grades versus block estimates.

13.15.1 Halfmile Project Well-Informed Block Grades versus Estimates

Figure 25 shows a comparison of composited zinc grades against estimated block zinc grades and Figure 26 shows lead composite grades against estimated block grades with borehole composite assay data contained within those blocks. The model tends to slightly overestimate the lower grade values, below 3% zinc, and underestimate the highest grade. However, on average, the estimated block grades are similar to the composite data, with good correlation between the estimates and the assays for grades in the cut-off ranges of 4.5 to 9.5% zinc.

13.15.2 Stratmat Project Well Informed Block Grades versus Estimates

Figure 27 shows a comparison of composited zinc grades against estimated zinc grades and Figure 28 shows lead composite grades against block grades with borehole composite assay data contained within those blocks. The model tends to overestimate the lower grade values and underestimate the highest grade but on average, the estimated block grades are similar to the composite data, with good correlation between the estimates and the assays for grades in the cut-off ranges of 3 to 6% zinc.

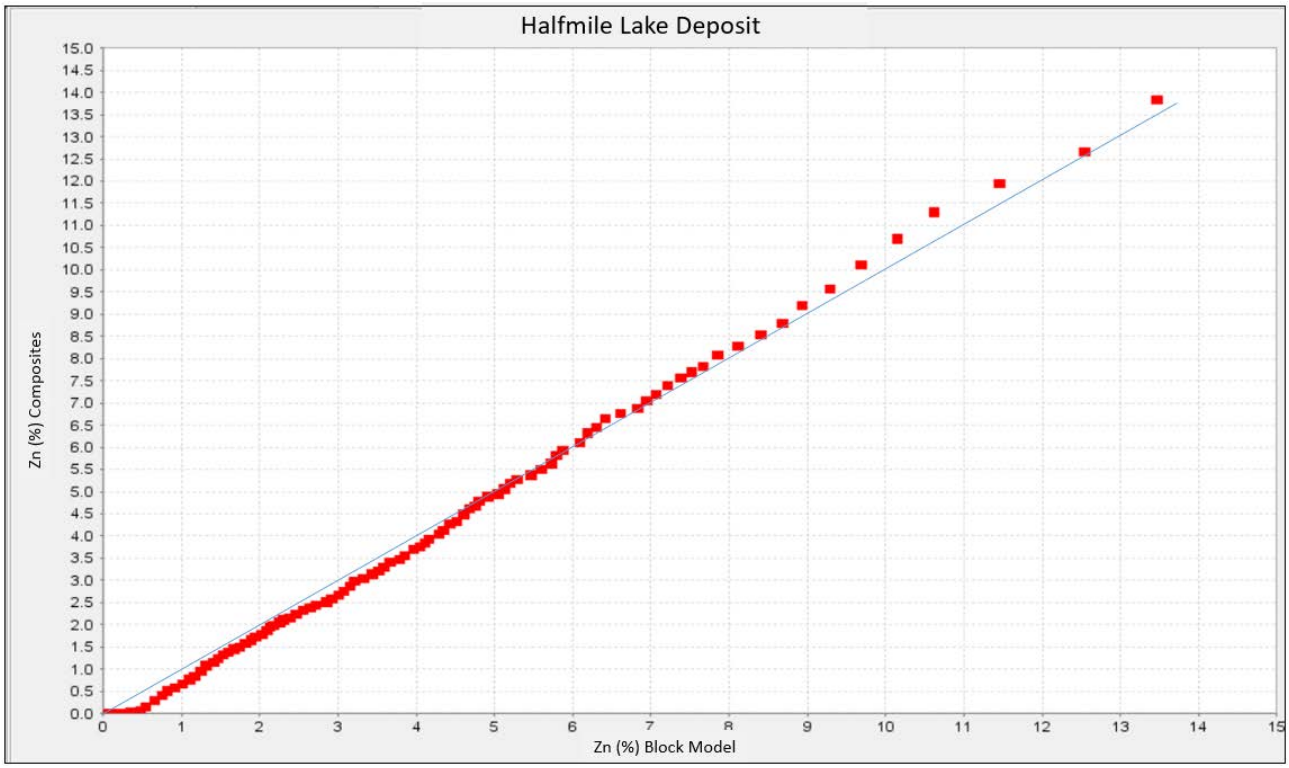


Figure 25: Comparison of Zinc Block Estimates Against Zinc Composites for Halfmile Project

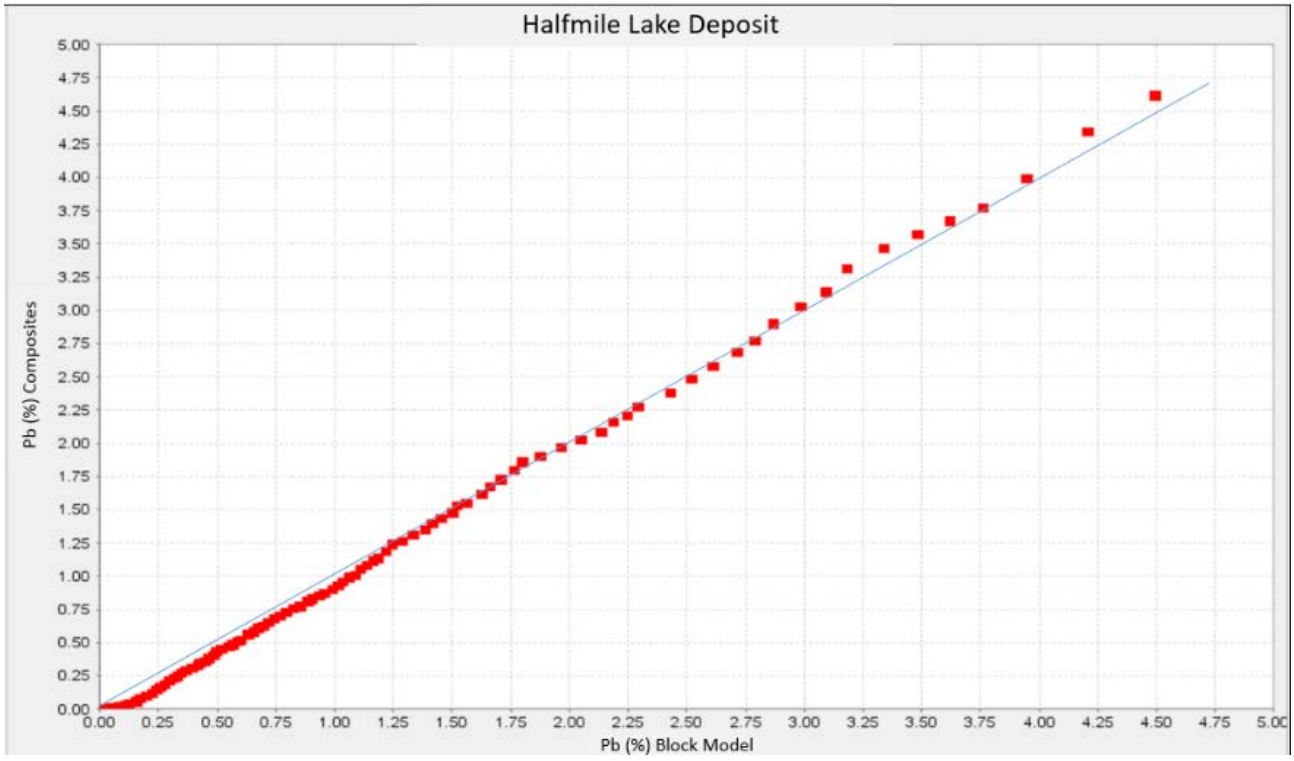


Figure 26: Comparison of Lead Block Estimates Against Lead Composites for Halfmile Project

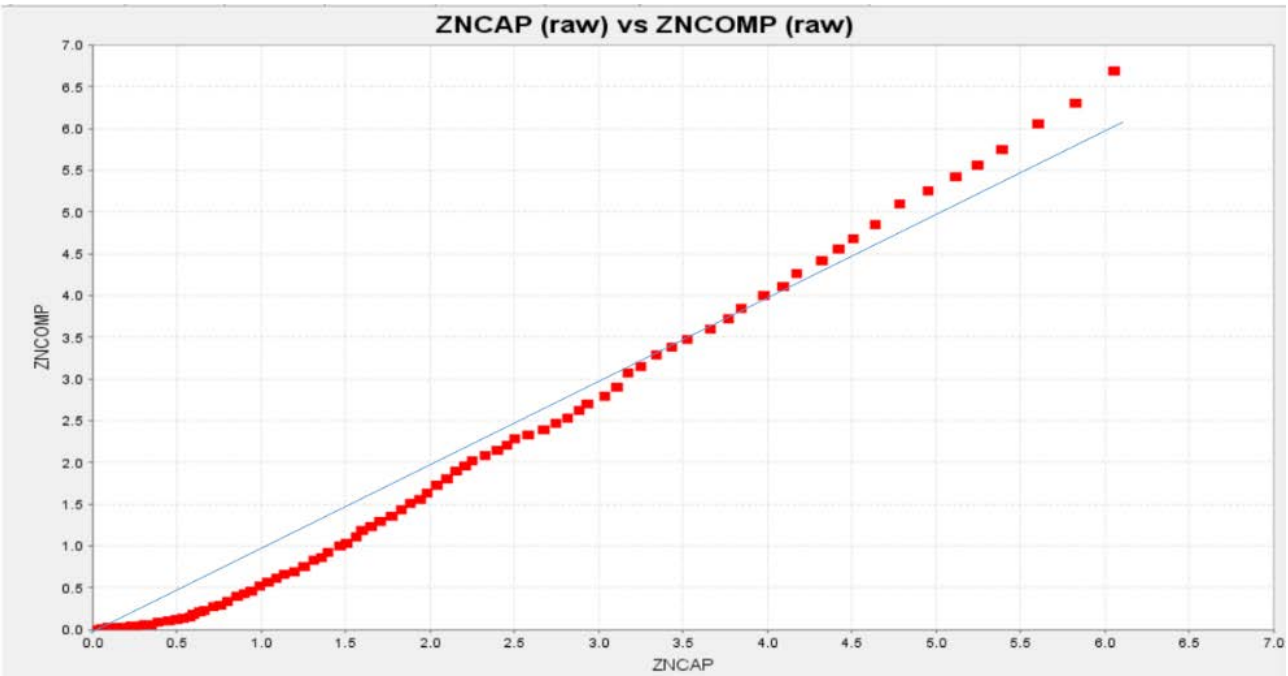


Figure 27: Comparison of Zinc Block Estimates Against Zinc Composites for Stratmat Project

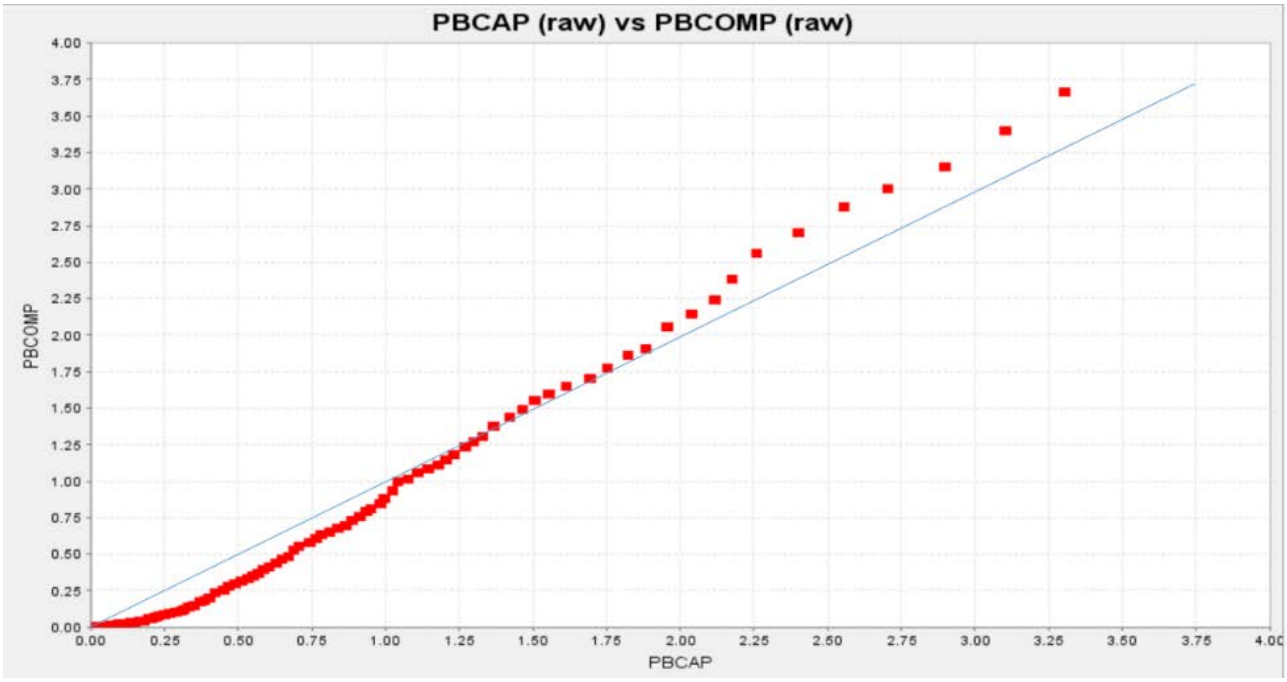


Figure 28: Comparison of Lead Block Estimates Against Lead Composites for Stratmat Project

13.15.3 Halfmile Project Swath Plots

Average composite grades and average block estimates were compared along different directions. This involved calculating de-clustered average composite grades and comparing them with average block estimates along east-west, north-south and horizontal (by elevation) swaths.

Because of the complex folding structure of the Halfmile projectand because of the wide-spaced drilling in some of the zone, the comparison was restricted to the Upper and Lower mineralized zones. Figure 29 and Figure 30 show the swath plots for zinc down dip and parallel to the strike of the Upper and Lower zones. Block estimates generally agree well with the composite averages with the composites being slightly higher than the block estimates. Similar results were achieved for lead and silver.

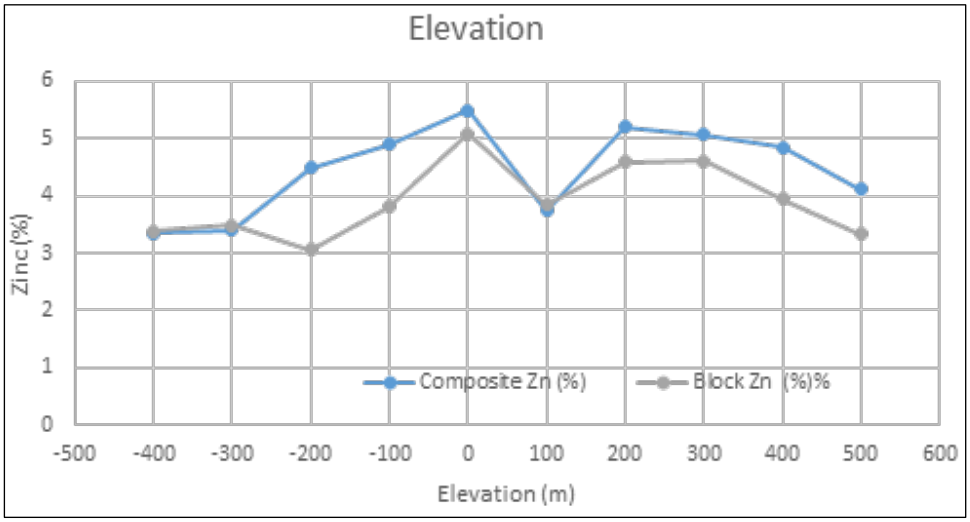


Figure 29: Elevation Swath Plot for Zinc for Upper and Lower Zones Only

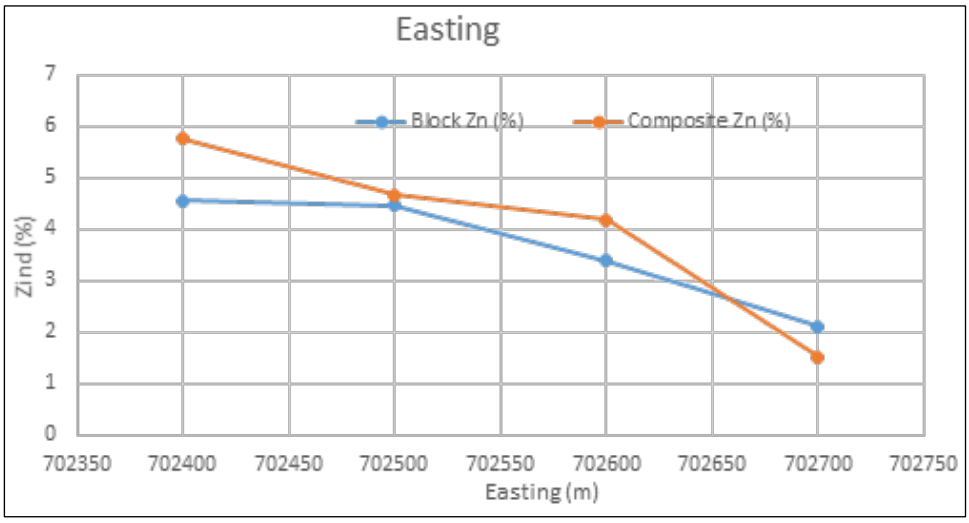


Figure 30: East-West Swath Plot for Zinc for Upper and Lower Zones Only

13.15.4 Stratmat Project Swath Plots

Average composite grades and average block estimates were compared along different directions. This involved calculating de-clustered average composite grades and comparing them with average block estimates along east-west, north-south and horizontal (by elevation) swaths.

Figure 31 to Figure 33 show the swath plots for zinc along the three directions. Block estimates generally agree well with the composite averages with the composites being slightly higher than the block estimates and showing more variability (less smoothing). Similar results were achieved for lead and silver.

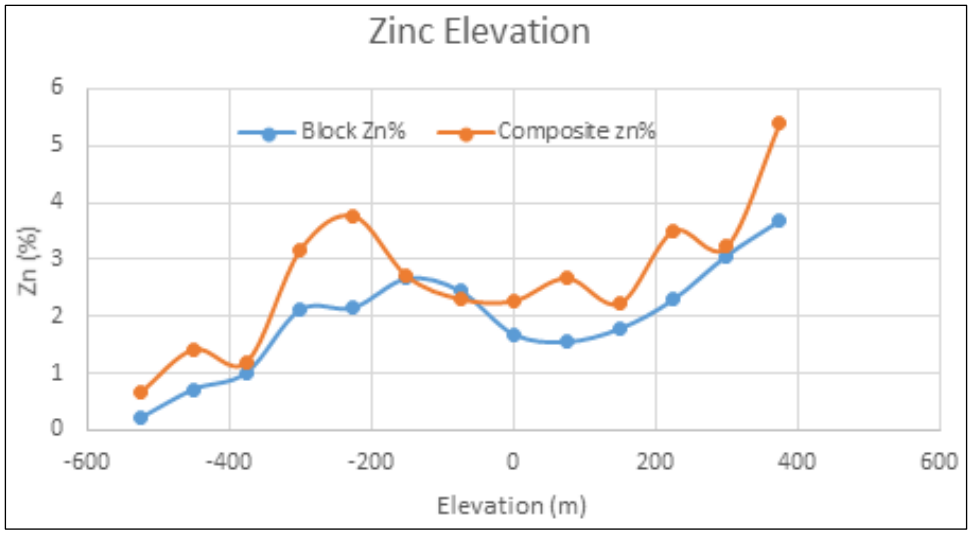


Figure 31: East-West Swath for Zinc (all zones)

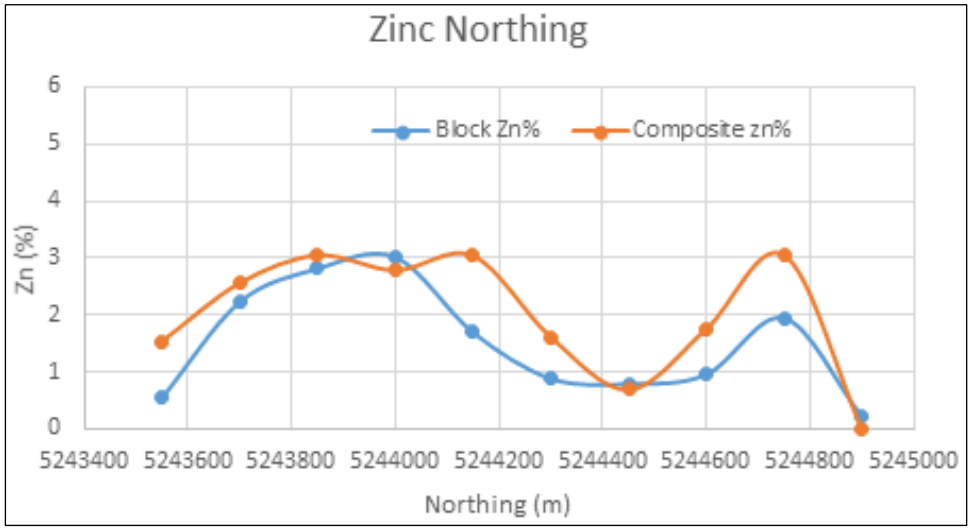


Figure 32: North-South Swath Plot for Zinc (all zones)

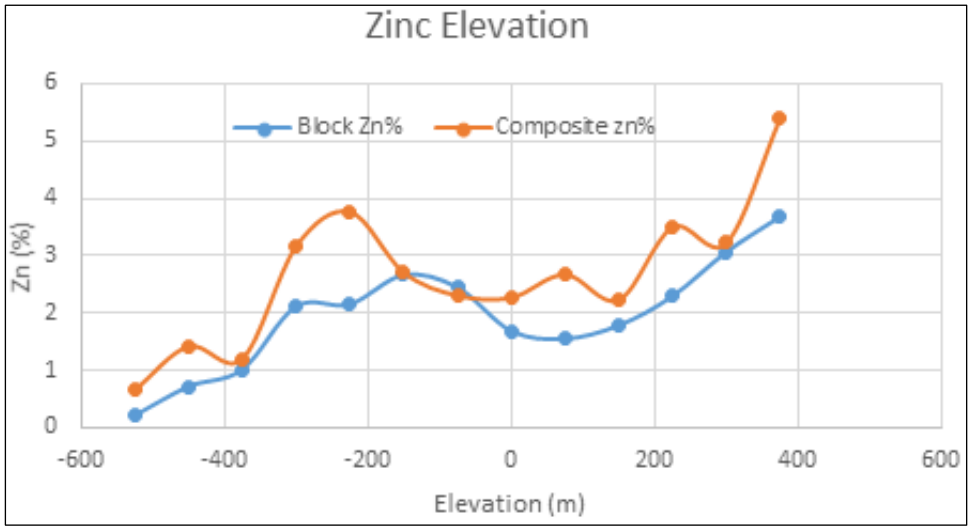


Figure 33: Elevation Swath Plot of Zinc (all zones)

13.15.5 Halfmile Project Visual Comparisons

Block model grades were compared to the composited data in plans and sections for each of the mineralized zones. In general, the block model grades agree well with the composited data. Figure 34 shows the zinc grades for the Lower zone on block model Column 240 (702,400 East).

13.15.6 Stratmat Project Visual Comparisons

Block model grades were compared to the composited data in plans and sections for each of the mineralized zones. In general, the block model grades agree well with the composited data. Figure 35 shows the zinc grades for the S1 Deep zone on block model level 96, elevation -80 m.

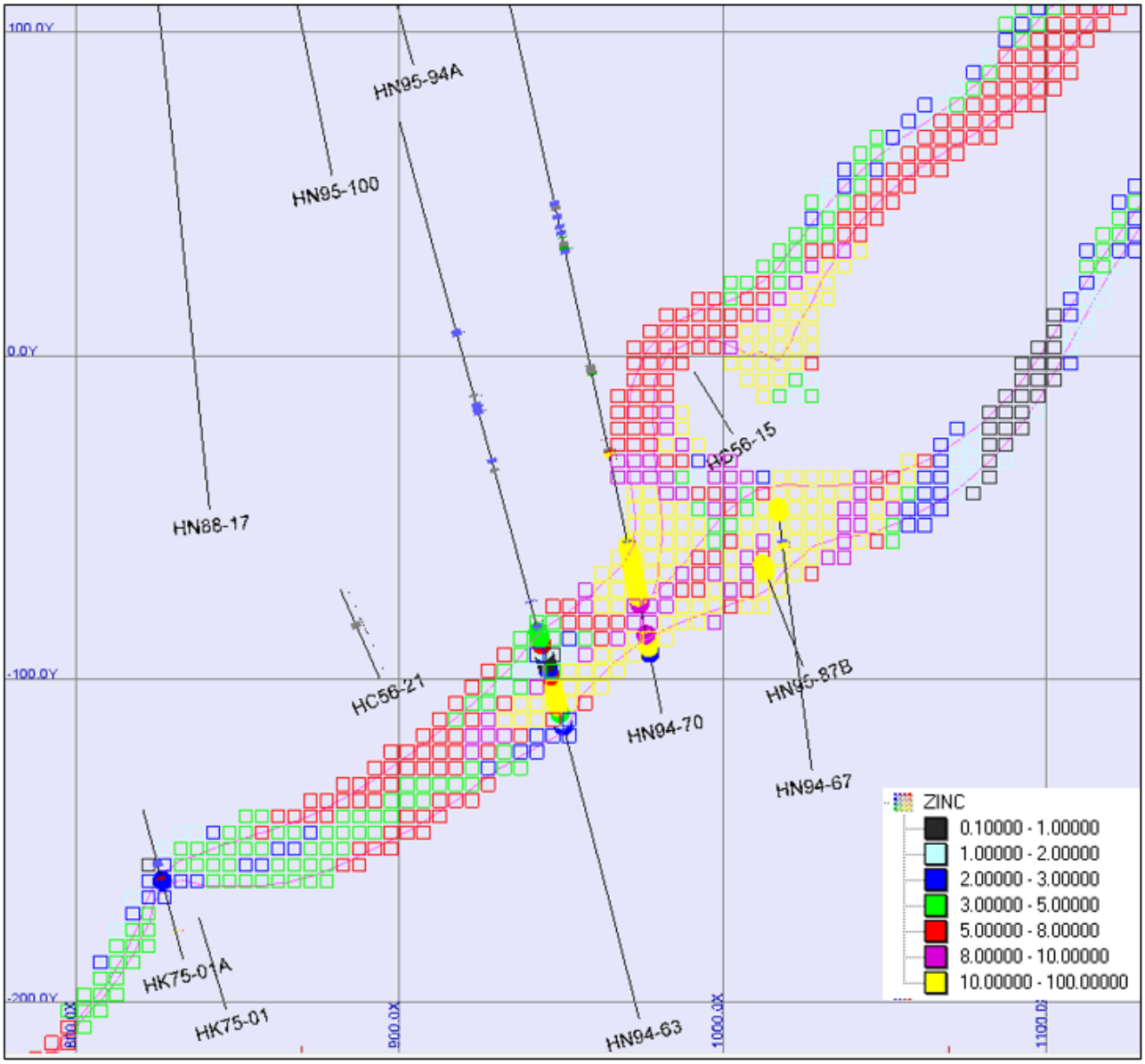


Figure 34: Cross Section on Block Model Column 240 Showing Block Model and Composite Zinc Grades

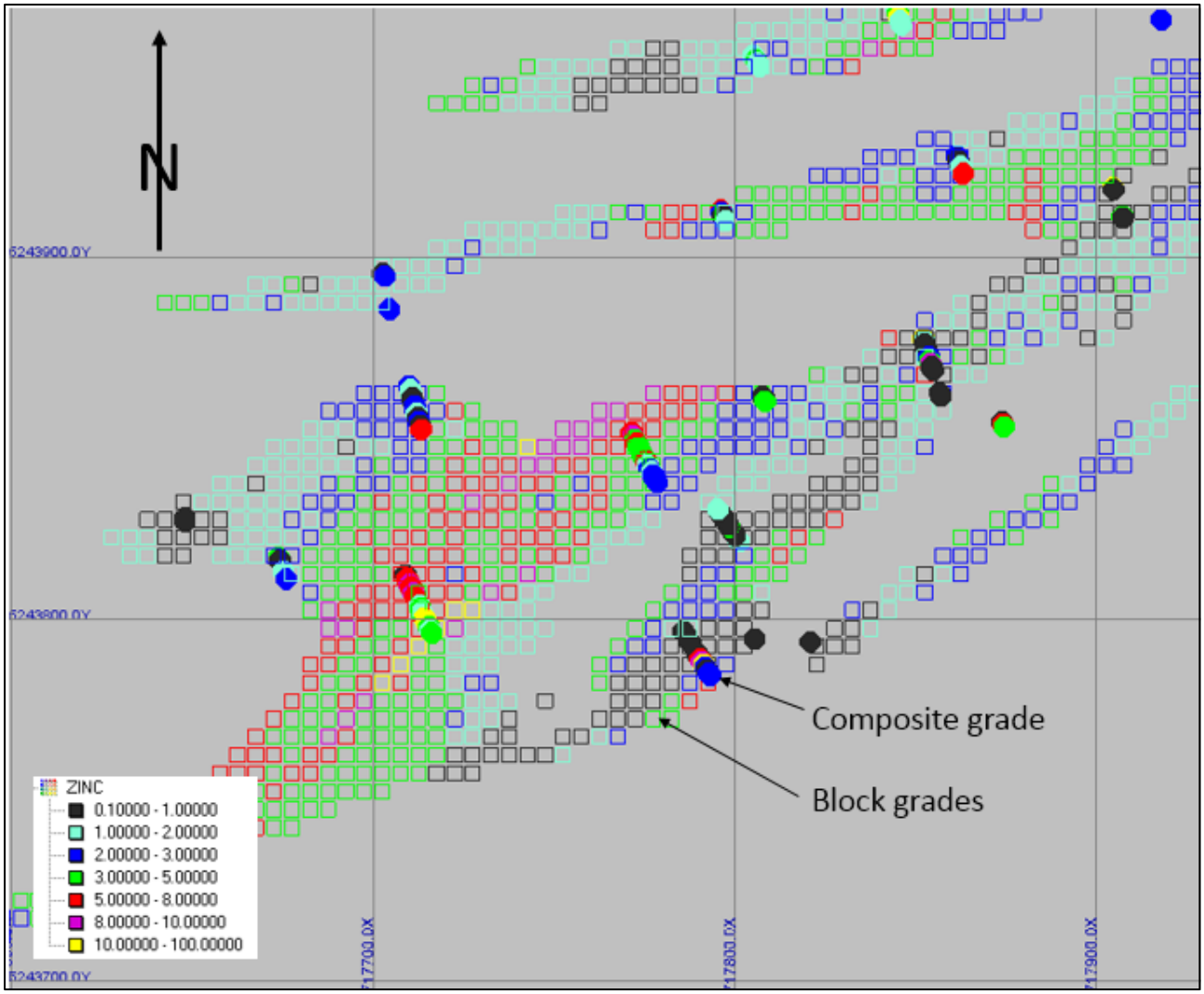


Figure 35: Plan View of S1 Deep Zone at -80 m Elevation Showing Block and Composite Zinc Grades (Note: Grid lines are 100 m apart)

Source: SRK (2015)

13.16 Mineral Resource Classification

Block model quantities and grade estimates for the Halfmile-Stratmat integrated project were classified according to the CIM Definition Standards for Mineral Resources and Mineral Reserves (May 2014) by Gilles Arseneau, PGeo (APEGBC), an appropriate independent QP for the purpose of NI 43-101.

Mineral resource classification is typically a subjective concept. Industry best practices suggest that resource classification should consider both the confidence in the geological continuity of the mineralized structures, the quality and quantity of exploration data supporting the estimates and the geostatistical confidence in the tonnage and grade estimates. Appropriate classification criteria should aim at integrating both concepts to delineate regular areas at similar resource classification.

SRK is satisfied that the geological modelling for both Halfmile and the Stratmat projects honours the current geological information and knowledge. The location of the samples and the assay data are sufficiently reliable to support resource evaluation. The sampling information was acquired primarily by core drilling on sections spaced at 30 to 50 m.

Generally, for mineralization exhibiting good geological continuity investigated at an adequate spacing with reliable sampling information accurately located, SRK considers that blocks estimated during the first estimation run and from at least three boreholes can be classified in the Indicated category within the meaning of the CIM Definition Standards for Mineral Resources and Mineral Reserves (May 2014). For those blocks, SRK considers that the level of confidence is sufficient to allow appropriate application of technical and economic parameters to support mine planning and to allow evaluation of the economic viability of the deposit. Those blocks can be appropriately classified as Indicated. Blocks that were classified as Indicated and located within 10 m of a mining opening were upgraded to the Measured category.

Conversely, blocks estimated during the second and third passes, considering search neighbourhoods, were classified in the Inferred category because the confidence in the estimate is insufficient to allow for the meaningful application of technical and economic parameters or to enable an evaluation of economic viability.

CIM Definition Standards for Mineral Resources and Mineral Reserves (May 2014) defines a mineral resource as:

"(A) concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling".

The phrase 'reasonable prospects for eventual economic extraction' implies a judgment in respect of the technical and economic factors likely to influence the prospect of economic extraction. Assumptions include estimates of cut-off grade and geological continuity at the selected cut-off, metallurgical recovery, smelter payments, commodity price or product value, mining and processing method and mining, processing and general and administrative costs. In order to meet this requirement, SRK considers that major portions of the Halfmile-Stratmat integrated project are amenable for underground extraction.

13.17 Halfmile Project Mineral Resource Statement

In order to determine the quantities of material offering "reasonable prospects for economic extraction" by an underground mining technique, the Halfmile block model quantities and grade estimates were reviewed based on parameters summarized in Table 41. The reader is cautioned that there are no mineral reserves on the Halfmile-Stratmat integrated project.

Table 41: Conceptual Assumptions Considered for Underground Resource Reporting for Halfmile Project

Parameter	Value	Unit
Gold price	1,250	US$ per ounce
Silver price	20.00	US$ per ounce
Copper price	3.00	US$ per pound
Lead Price	0.95	US$ per pound
Zinc price	1.05	US$ per pound
Exchange rate	0.80	$US/$CAD
Mining costs	40	US$ per tonne mined
Process and G&A costs	36	US$ per tonne of feed
Mining dilution	16	percent
Gold recovery	0	percent
Silver recovery	45	percent
Copper recovery	50	percent
Lead recovery	72	percent
Zinc recovery	88	percent

Based on the above assumptions, zinc equivalent estimated block grades were calculated from the following formula:

Zn_Eq = ((zinc grade * zinc price * zinc recovery) + (lead grade * lead price * lead recovery) + (copper grade * copper price * copper recovery) + (silver grade * silver price * silver recovery))/(zinc price)

SRK estimated that at a 5% zinc equivalent, the Halfmile projectcontained mineral resources as defined in Table 42.

Table 42: Mineral Resource Statement*, Halfmile Project, Halfmile-Stratmat Integrated Project, New Brunswick, SRK Consulting, June 23, 2016

Category Underground**	Quantity (Mt)	Grade					Metal				
		Au g/t	Ag g/t	Pb %	Zn %	Cu %	Au M oz	Ag M oz	Pb M lbs	Zn M lbs	Cu M lbs
Measured	0.4	0.60	40	1.99	5.92	0.46	0.01	0.52	18	54	4
Indicated	7.4	0.29	35	2.37	7.00	0.16	0.07	8.45	389	1,146	26
Measured & Indicated	7.8	0.30	36	2.35	6.94	0.18	0.08	8.98	407	1,199	31
Inferred	6.5	0.10	23	1.51	5.62	0.15	0.02	4.72	216	806	21

* Mineral resources are not mineral reserves and do not have demonstrated economic viability. All figures are rounded to reflect the relative accuracy of the estimate. All composites have been capped where appropriate.

** Underground mineral resources are reported at a cut-off grade of 5% Zn equivalent. Cut-off grades are based on price for Au of US$1250 per ounce, Ag is US$20.00 per ounce, Cu is US$3.00 per pound, Pb is US$0.95 per pound, and Zn is US$1.05 per pound, and exchange rate US$0.80 per Canadian dollar. A recovery of 88% was applied to Zn, 72% was applied to Pb, 50% was applied to Cu, 45% was applied to Ag, and 0% was applied to Au. The North zone is reported at 100% although only 61.5% of interest owned by Trevali.

13.18 Stratmat Project Mineral Resource Statement

In order to determine the quantities of material offering "reasonable prospects for economic extraction" by an underground mining technique, the Stratmat block model quantities and grade estimates were reviewed based on parameters summarized in Table 43. The reader is cautioned that there are no mineral reserves on the Halfmile-Stratmat integrated project.

Table 43: Conceptual Assumptions Considered for Underground Resource Reporting for Stratmat Project

Parameter	Value	Unit
Gold price	1,300	US$ per ounce
Silver price	21.15	US$ per ounce
Copper price	3.00	US$ per pound
Lead Price	1.00	US$ per pound
Zinc price	1.00	US$ per pound
Exchange rate	0.85	$US/$CAD
Mining costs	40	US$ per tonne mined
Process and G&A costs	36	US$ per tonne of feed
Mining dilution	16	percent
Gold recovery	0	percent
Silver recovery	45	percent
Copper recovery	50	percent
Lead recovery	72	percent
Zinc recovery	88	percent

Based on the above assumptions, zinc equivalent estimated block grades were calculated from the following formula:

Zn_Eq = ((zinc grade * zinc price * zinc recovery) + (lead grade * lead price * lead recovery) + (copper grade * copper price * copper recovery) + (silver grade * silver price * silver recovery))/(zinc price)

SRK estimated that at a 5% zinc equivalent, the Stratmat project contained mineral resources as defined in Table 44.

Table 44: Mineral Resource Statement*, Stratmat Project, Halfmile-Stratmat Integrated Project, New Brunswick, SRK Consulting, May 20, 2015

Category Underground**	Quantity (Mt)	Grade					Metal				
		Au g/t	Ag g/t	Pb %	Zn %	Cu %	Au M oz	Ag M oz	Pb M lbs	Zn M lbs	Cu M lbs
Indicated	4.7	0.6	49	2.1	5.3	0.4	0.09	7.3	214	550	43
Inferred	2.4	0.4	39	2.1	4.8	0.7	0.03	3.0	110	252	37

* Mineral resources are not mineral reserves and do not have demonstrated economic viability. All figures are rounded to reflect the relative accuracy of the estimate. All composites have been capped where appropriate.

** Underground mineral resources are reported at a cut-off grade of 5% Zn equivalent. Cut-off grades are based on price for Au of US$1300 per ounce, Ag is US$21.15 per ounce, Cu is US$3.00 per pound, Pb is US$1.00 per pound, and Zn is US$1.00 per pound, and exchange rate US$0.85 per Canadian dollar. A recovery of 88% was applied to Zn, 72% was applied to Pb, 50% was applied to Cu, 45% was applied to Ag, and 0% was applied to Au.

13.19 Halfmile Project Grade Sensitivity Analysis

The mineral resources of the Halfmile project are sensitive to the selection of the reporting cut-off grade. To illustrate this sensitivity, the model quantities and grade estimates are presented in Table 45 and Table 46 at different cut-off grades. The reader is cautioned that the figures presented in this table should not be misconstrued with a Mineral Resource Statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of cut-off grade. Figure 36 and Figure 37 present this sensitivity as grade tonnage curves.

Table 45: Measured and Indicated Block Model Quantities and Grade Estimates*, Halfmile Project at Various Zinc-Equivalent Cut-off Grades

Cut off Zn Eq (%)	Tonnes (Mt)	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)
10	1.7	3.92	10.91	0.14	59	0.37
9	2.5	3.57	9.98	0.15	54	0.36
8	3.4	3.27	9.20	0.16	49	0.35
7	4.5	2.98	8.45	0.17	45	0.35
6	5.9	2.68	7.71	0.17	41	0.33
5	7.8	2.35	6.94	0.18	36	0.30
3	12.9	1.79	5.56	0.17	28	0.26

* The reader is cautioned that the figures in this table should not be misconstrued with a Mineral Resource Statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of cut-off grade.

Table 46: Inferred Block Model Quantities and Grade Estimates*, Halfmile Project at Various Zinc-Equivalent Cut-off Grades

Cut off Zn Eq (%)	Tonnes (Mt)	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)
10	0.1	4.27	9.20	0.09	92	0.35
9	0.5	2.82	8.31	0.22	54	0.26
8	1.0	2.34	7.99	0.21	44	0.21
7	1.4	2.19	7.52	0.19	38	0.20
6	2.8	1.83	6.65	0.16	29	0.14
5	6.5	1.51	5.62	0.15	23	0.10
3	15.8	1.15	4.25	0.14	18	0.10

* The reader is cautioned that the figures in this table should not be misconstrued with a Mineral Resource Statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of cut-off grade.

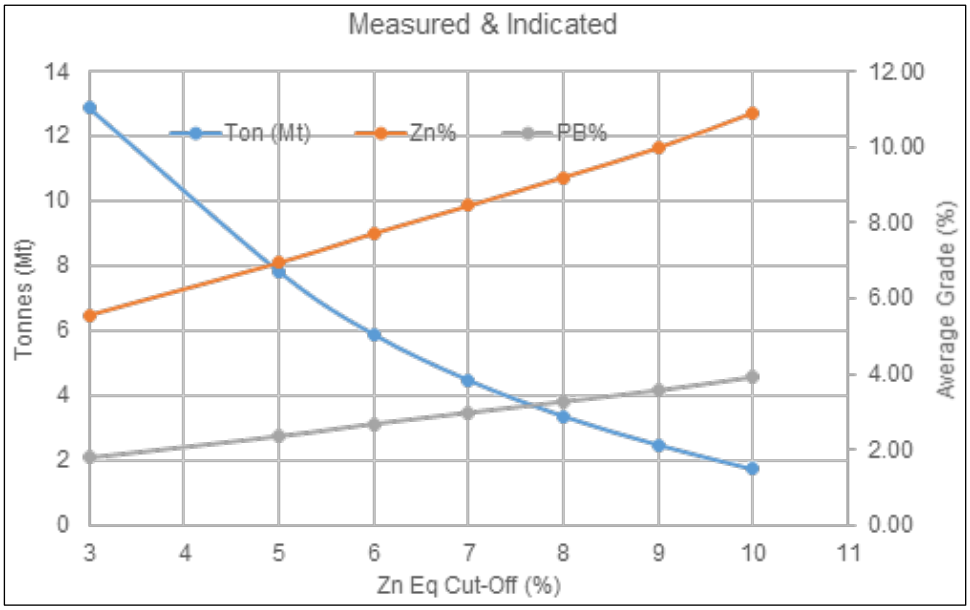


Figure 36: Grade Tonnage Curve for Measured and Indicated Mineral Resource Halfmile Project

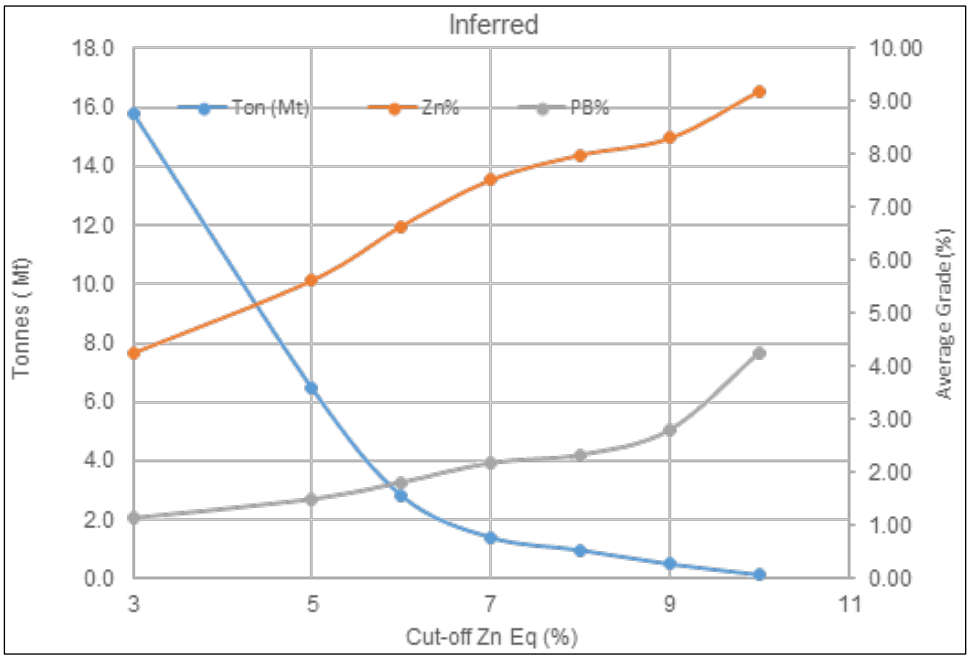


Figure 37: Grade Tonnage Curve for Inferred Mineral Resource Halfmile Project

13.20 Stratmat Project Grade Sensitivity Analysis

The mineral resources of the Stratmat projectare sensitive to the selection of the reporting cut-off grade. To illustrate this sensitivity, the model quantities and grade estimates are presented in Table 47 and Table 48 at different cut-off grades. The reader is cautioned that the figures presented in this table should not be misconstrued with a Mineral Resource Statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of cut-off grade. Figure 38 and Figure 39 present this sensitivity as grade tonnage curves.

Table 47: Indicated Block Model Quantities and Grade Estimates*, Stratmat Project at Various Zinc-Equivalent Cut-off Grades

Cut off Zn Eq (%)	Tonnes (Mt)	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)
10	0.6	3.70	8.92	0.39	78	0.9
8	1.4	3.03	7.43	0.41	66	0.8
7	2.1	2.71	6.75	0.41	61	0.7
6	3.2	2.39	6.03	0.41	55	0.7
5	4.7	2.07	5.31	0.41	49	0.6
3	9.2	1.50	3.99	0.42	37	0.5

* The reader is cautioned that the figures in this table should not be misconstrued with a Mineral Resource Statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of cut-off grade.

Table 48: Inferred Block Model Quantities and Grade Estimates*, Stratmat Project at Various Zinc-Equivalent Cut-off Grades

Cut off Zn Eq (%)	Tonnes (Mt)	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)
10	0.3	4.51	9.92	0.53	64	0.5
8	0.6	3.50	7.89	0.46	58	0.5
7	0.9	3.05	6.91	0.57	51	0.5
6	1.4	2.59	5.86	0.65	45	0.4
5	2.4	2.07	4.76	0.70	39	0.4
3	5.7	1.33	3.22	0.77	27	0.2

* The reader is cautioned that the figures in this table should not be misconstrued with a Mineral Resource Statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of cut-off grade.

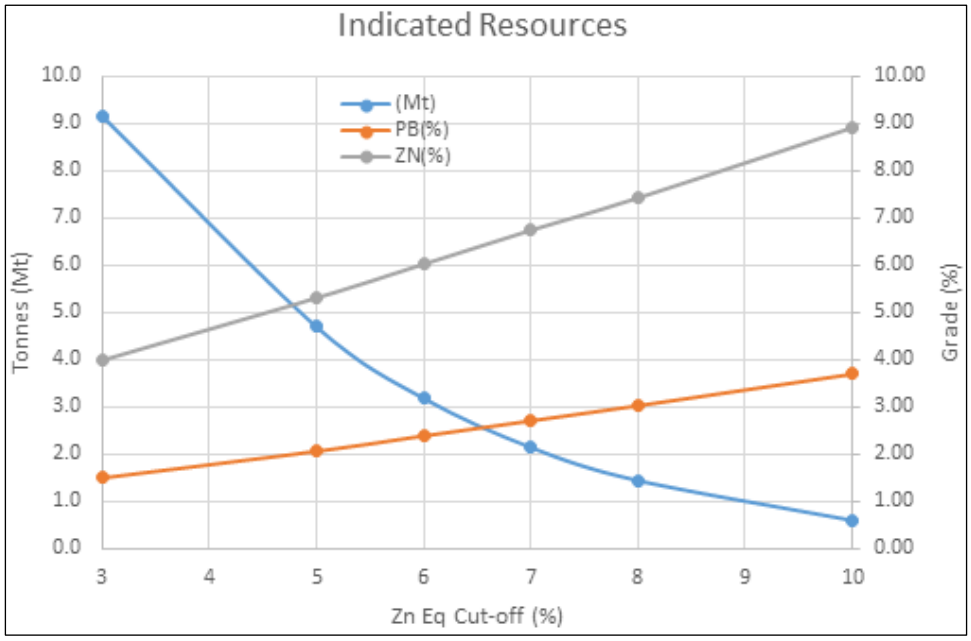


Figure 38: Grade Tonnage Curves for the Indicated Mineral Resources, Stratmat Project

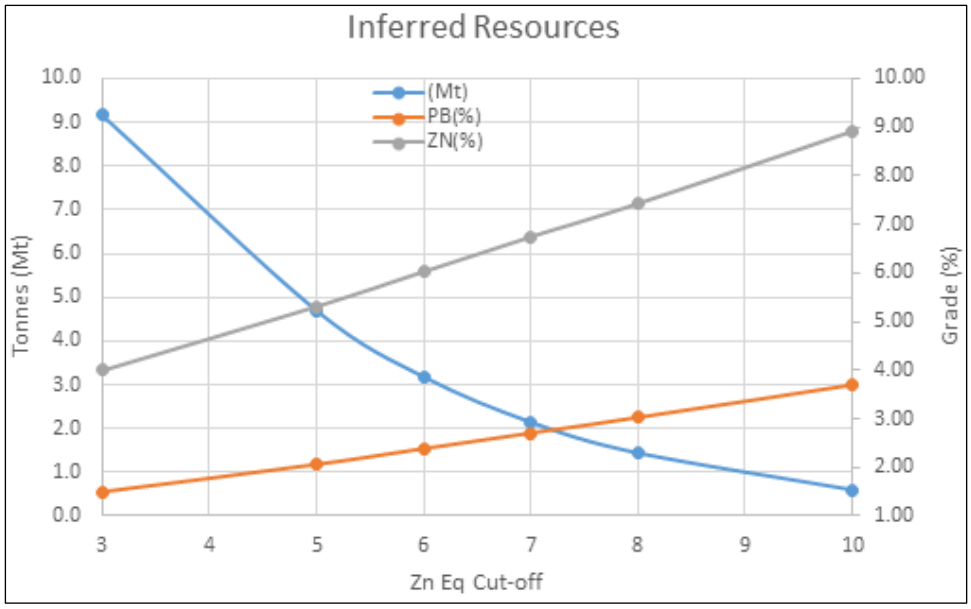


Figure 39: Grade Tonnage Curve for the Inferred Mineral Resources, Stratmat Project

13.21 Halfmile Project Previous Mineral Resource Estimates

Mineral resources were estimated for the Halfmile project in 2011 by Tetra Tech. The mineral resources were estimated for Trevali as part of a PEA of the Halfmile project. The mineral resources were estimated by inverse distance squared into 5 x 5 x 5 m blocks using GEOVIA GEMS modelling software. Tetra Tech estimated that the Halfmile project contained 6.2 million tons of indicated mineral resource grading 8.1% zinc, 2.6% lead 0.22% copper and 31 g/t silver along with 6.0 million tons of Inferred mineral resource grading 6.7% zinc, 1.8% lead, 0.14% copper and 21 g/t silver. All mineral resources were reported at a 5% zinc equivalent cut-off.

SRK did not do the work necessary to verify the Tetra Tech mineral resource estimate. The estimate is no longer relevant as it is superseded by the mineral resource presented in this Section of this report. The mineral resource is only stated here as a comparable to the mineral resources prepared by SRK.

13.22 Stratmat Project Previous Mineral Resource Estimates

Mineral resources were estimated for the Stratmat project in 2009 by Wardrop (now Tetra Tech). The resources were estimated for Kria Resources,the owners of the property at the time. The mineral resources were estimated by inverse distance squared into 3 x 3 x 3 m blocks using MineSight™ modelling software. Wardrop estimated that the Stratmat project contained 5.5 million tons of Inferred mineral resource grading 6.1% zinc, 2.6% lead 0.4% copper, 54 g/t silver and 0.6 g/t gold at a 5% zinc equivalent cut-off.

SRK didn’t do the work necessary to verify the Wardrop mineral resource estimate. The estimate is no longer relevant as it is superseded by the mineral resource presented in this Section of this report. The mineral resource is only stated here as a comparable to the mineral resources prepared by SRK.

14 Mineral Reserve Estimates

At the current stage, there are no mineral reserves declared for the Halfmile-Stratmat integrated project. To support a mineral reserve estimate, a prefeasibility study or a feasibility study is required.

15 Mining Methods

The objective of this preliminary economic assessment is to determine the potential economic viability of the Halfmile-Stratmat intergrated project at a scoping level. This section summarizes the mine design and planning work completed to support the PEA including the RoM schedule.

15.1 Hydrogeology

15.1.1 Work Completed to Date and Regional Experience

Little hydrogeological work has been completed at Halfmile or Stratmat to date. A paper published in the Canadian Geotechnical Journal (Park and Foster 1996) during the Heath Steele phase of operation describes "excessive" groundwater inflow to surface and underground workings associated with iron-oxide stained sand and clay-filled joints. The inflow was considered to have been associated with glaciotectonic activity and responsible for re-activating movement along schistosity planes to depths of up to 120 m. Relatively unfractured felsic volcanic, sedimentary, and intrusive country rock are considered to generally be of low permeability.

During the Trevali trial mining period at the Halfmile Mine limited water ingress was noted from the upper levels of the deposit. Groundwater inflows documented at Trevali's Caribou massive sulphide mine in the BMC—which has been mined intermittently from 1970 to 2008, (re-opened in 2014, and in production now) – are modest with peak flows documented at about 200 US gallons per minute or 13 litres per second (L/s), which is potentially analogous to the Halfmile and Stratmat deposits from a hydrogeological perspective.

VMS deposits and the BMC area are well-known for the common occurrence of significant acid and metalliferous drainage. The Heath Steele tailings area was used as a case study for the rehabilitation of acid-generating tailings (MEND 2004).

15.1.2 Groundwater Management

Based on the limited data available, it is likely the Stratmat project and to a lesser extent the Halfmile deposit have potential for moderate groundwater inflows. In addition, the occurrence of groundwater may play a significant role in at least shallow geotechnical stability.

Given significant sink rates at Halfmile and Stratmat, the potential groundwater inflow at each mine could be similar to those observed at the Caribou Mine.

Given the probable need to treat mine water, it will be advantageous to separate contact and non-contact water wherever possible to limit water treatment requirements. Given the water treatment requirements, it will be desirable to have greater resolution on the quantity of and expected chemistry groundwater reporting to the mine during the construction, operation and post-closure phases than would otherwise be the case for more benign water chemistry.

Future hydrogeological investigation should focus on confirming the hydraulic properties of key rock units on site and the identification and hydraulic testing of permeable structures. Documentation of circulation losses in exploration and other boreholes provides useful data with which to plan a hydrogeological investigation. A number of open holes are present at site, some cased with PVC to

allow access for geophysical surveying. These holes may be useful installation of standpipe or vibrating wire piezometers for collection of piezometric, hydraulic, and water chemistry data. Packer-based hydraulic testing of existing open holes and holes being drilled for mineral resource, geotechnical or metallurgical purposes will also provide useful information for the hydrogeological assessment.

15.2 Mine Geotechnical

15.2.1 Halfmile Project Geotechnical

There is no formal geotechnical study for the Halfmile project underground deposit to support this PEA. Based on a review of historical information and discussions with site geologists and mining engineers, the following summary from Section 6.2 and the SRK technical memorandum titled "Phase 1 Geotechnical Guideline" dated May 27, 2011 (SRK 2011) represent the best information available describing the Halfmile deposit rock mass quality.

Geologic Setting

The geologic setting was generally rephrased from Section 6.2. It describes several lithologies of direct importance to stope design. Brief summaries are shown below:

Stratigraphy and Massive Sulphides

The Halfmile project is underlain predominantly felsic volcanic rocks and lesser sedimentary rocks which are host to all massive sulphide deposits on the property.

Stockwork

A stockwork of pyrrhotite-chalcopyrite mineralization occurs on top of the massive sulphides. Well-developed S1 foliation/cleavage is oriented northeast with a dip of 40 to 60° to the northwest. An S2 crenulation cleavage is oriented at a high angle to the S1 foliation in the nose of folds.

Structure

The stratigraphy for Halfmile is overturned. A single thrust fault is readily observed immediately above or within the sulphide horizon. This fault occurs in about the same stratigraphic position on all of the Halfmile project.

Halfmile Project Preliminary Geotechnical Domain

The geotechnical properties below are summarized from SRK (2011).

Geomechanical properties were derived from the 2010 and 2011 core logs and photos. Rock quality designation (RQD) data and visual assessment of joint properties were also made.

Review of the data and a brief statistical assessment identified three basic domains relating to lithology and the mining configuration for the HW, mineralization zone (MS), and footwall (FW):

- HW – Stockworks (Argillite)
- MS – Massive sulphides
- FW – Andesite

Figure 40 shows representative core photos from HK11-07 for the three domains.

RQD variability/confidence was assessed by reviewing histograms of the data. Data were assessed by lithology, general spatial correlation to the mining blocks, and areas bordering the

mineralization/vein (immediate back and floor). Comparative histograms were also generated, and the histogram data lead to the use of the 40% confidence limits to mean values for the design.

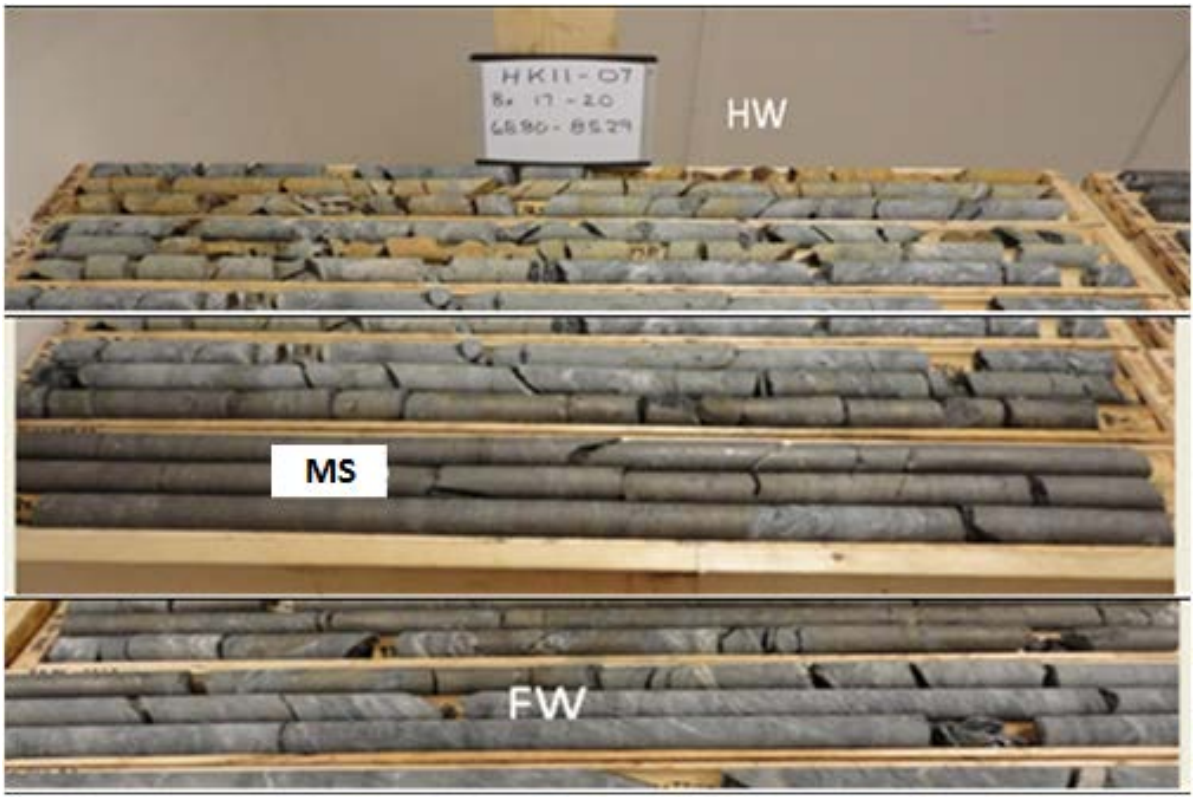


Figure 40: Core Photos Used for Halfmile Project Preliminary Rock Mass Assessment

Halfmile Project Preliminary Rock Mass Clarification

Table 49 shows the properties derived for the rock geotechnical domains. There were only minor adjustments to the RQD values from the preliminary report.

Table 49: Halfmile Project Preliminary Rock Mass Clarification

	HW	MS	FW
UCS (MPa)*	50-100	100-250	100-250
RQD (%)	60-65	70-80	70-80
RMR89	58	72	73
Q	4.6	22	24
GSI	55-60	65-75	65-75

* Field estimate only

Halfmile Project Post Pillar Cut and Fill Opening Analysis

Post Pillar Cut and Fill (PPCF) Stope Spans

Using the rock mass properties derived above, an assessment of openings was conducted. Empirical data from Barton, Lien and Lunde (1974) and Ouchi, Palaknis and Brady (2004) shown in Figure 41 and Figure 42 indicate reasonable spans of 10 to 12 m in the HW. The massive sulphide mineralization and FW rocks are better and therefore not limiting factors.

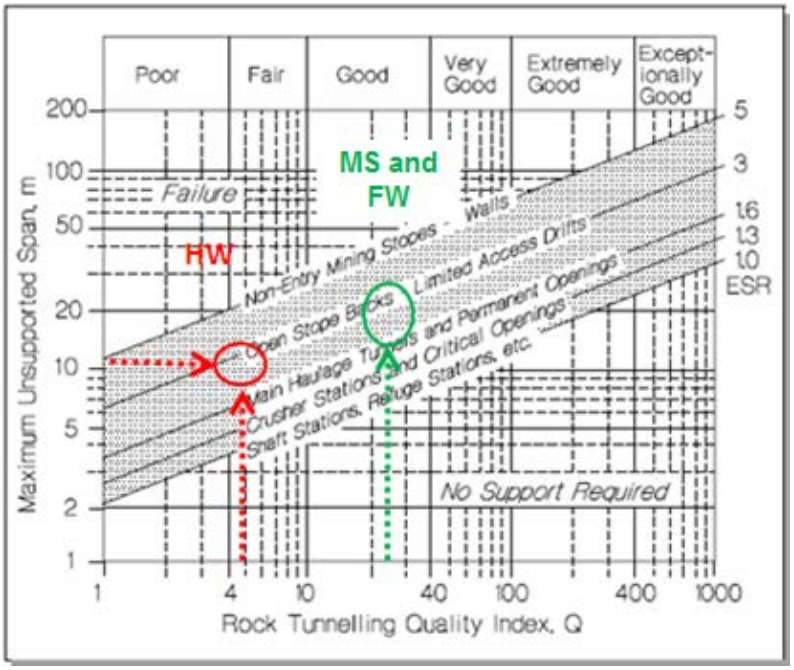


Figure 41: PPCF Stope Span Estimates from the Q Database (Barton, Lien and Lunde 1974, SRK 2011)

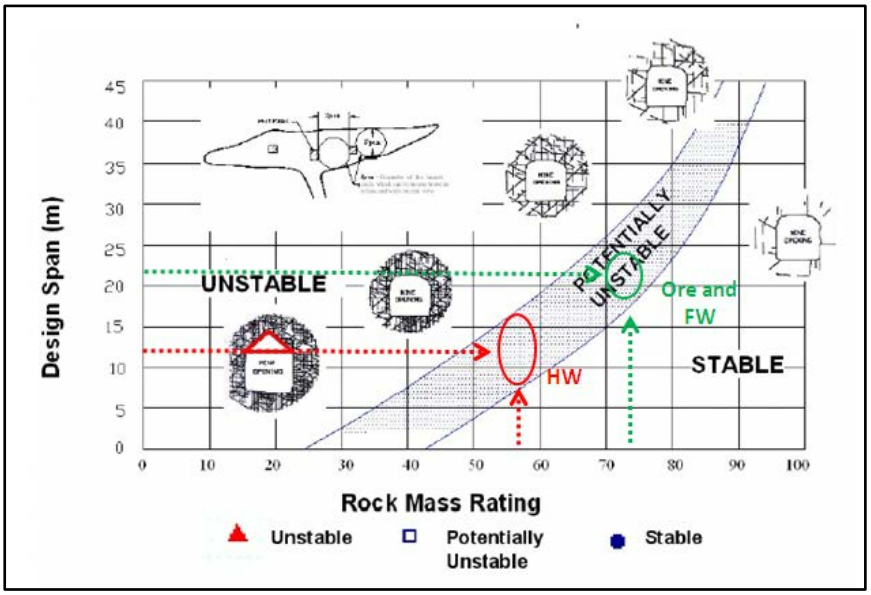


Figure 42: PPCF Span Estimates from Ouchi's Database Ouchi, Palaknis and Brady (2004); SRK (2011)

PPCF Stope Pillars

Should mining width exceed span limits, pillars may be required. Cut and fill pillar evaluations were conducted using tributary area load analyses and general pillar equations (Obert and Duval 1967). Rock strength and shallow depths indicate pillars will not be a significant problem. There may, however, be minimum limits on sizes that can be successfully excavated by drill and blast methods. Experience indicates pillars of 4 x 4 or 5 x 5 m are generally manageable by drill and blast. Figure 43 shows factors of safety for pillar configurations anticipated in the Upper zone. The yellow zone showing the general design limit to be around 90% extraction ratio.

It is recommended this analysis be updated when the lab test data become available.

The 90% extraction ratio is actually higher than achievable given the spans and pillar limits discussed. Table 50 shows possible extraction rates for 10 to 12 m spans and 4 to 5 m square pillars.

Obert Analysis	S = UCS(.778+.222(W/H))								
Vert Stress @ 300m	8.1								
Factor of Safety to Yield	Obert Pillar Strength	Pillar Height (m)							
		5				15			
		Pillar Width (m)							
		3.0	4.0	5.0	6.0	3.0	4.0	5.0	6.0
		Width : Height							
Extraction	Tributary Stress (MPa)	0.6	0.8	1.0	1.2	0.2	0.3	0.3	0.4
50%	16	5.6	5.9	6.2	6.4	5.1	5.2	5.3	5.4
55%	18	5.1	5.3	5.6	5.8	4.6	4.7	4.7	4.8
60%	20	4.5	4.7	4.9	5.2	4.1	4.1	4.2	4.3
65%	23	3.9	4.1	4.3	4.5	3.6	3.6	3.7	3.7
70%	27	3.4	3.5	3.7	3.9	3.0	3.1	3.2	3.2
75%	32	2.8	2.9	3.1	3.2	2.5	2.6	2.6	2.7
80%	41	2.2	2.4	2.5	2.6	2.0	2.1	2.1	2.1
85%	54	1.7	1.8	1.9	1.9	1.5	1.6	1.6	1.6
90%	81	1.1	1.2	1.2	1.3	1.0	1.0	1.1	1.1
95%	162	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5
99%	810	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Figure 43: Pillar Analyses

Table 50: Extraction Ratios Based on Preliminary Recommended Design Guidelines

Extraction Ratio	Stope Span (m)	
Pillars (m x m)	10	12
5	75%	83%
4	84%	89%

Sill Pillar Analyses

The sill pillars were analyzed using tributary area and numerical modelling. Rock strengths were estimated by lithology and stresses by estimates from “regional” data. Rock strength data is pending and should be used to update the evaluations when completed. The stress data carry significant uncertainty so a reasonable factor of safety needs to be applied at this time, say 1.5–2.0.

The tributary area analysis results showed that the 2010 design implemented during 2011 to 2012 trial mining has pillars varying from approximately 15−25 m in horizontal distance with 5 mining cuts above and below each sill. Preliminary designs were for 5 m thick sill pillars. This appears to be

too thin. Seven meters appears more reasonable for the planned widths, with factors of safety ranging from 1.8 to 1.4. This analysis does not reflect the support given by the vertical pillars; it is also predicated on good blasting, so the wide span, 20+ m areas, with low factors of safety are still reasonable.

Instead of the waste rock fill (RF) that was used in the 2011 to 2012 trial mining, the current PEA mine design proposes using cemented rock fill (CRF) for the first lift of the new mining block/front. Doing so would avoid permanent sill pillar to be left on the lower mining block and increase overall mining recovery.

Crown Pillar Analysis

It is expected that HW deterioration will be experienced in late-stage mining for the Upper zone due to its shallow depth of the top mineralization limits. The moderate dip allows a large surface area to relax and sag, causing some shear and tensile failure in the rock mass. This, however, is not a significant problem when considering displacements and surface subsidence. Preliminary numerical modelling shows the net surface displacement will be in the order of less than four centimetres. Backfill is key to limiting the HW movements. The only risk or issues caused by this would be for more rapid water migration through the fractured HW. This could result in increased dewatering costs, impacts to overlying aquifers if any and potential stability concerns from water migrating to the lower levels of the mine. Risk considerations should be discussed and reviewed further in the next stage of mining study.

Halfmile Project Sublevel Open Stope Dimension Analysis

Sublevel open stope (SLOS) with backfill (CRF for primary stope and RF for secondary stope) was selected as preferred mining methods for the majority of Lower zone and Deep zone mineralizations, where the mineralization widths are more than 10–15 m and the dipping angle is amenable to longhole open stope mining. For the narrower and isolated veins, modified Avoca is preferred.

The SLOS and modified Avoca stope dimension analysis was based on rock mass properties shown in Table 49 and empirical stability graph method (Potvin 1988), as shown in Figure 44. Due to lack of detailed joint sets and their orientations as well as in situ stress information, derived factors from Caribou Mine were used to assess rock stress factor (A), joint orientation factor (B), gravity adjustment factor (C), and thus a modified stability graph number (N').

Table 51 shows the estimate maximum hydraulic radius for different stope rock faces without additional ground support.

Stope height trade-off study (15, 20, and 25 m in heights) shows that 20 m high stope provide more economical results, considering internal dilution, potential external dilution, NSR, capital and operating development and associated costs, cemented backfill strength requirement and associated cost, and ease of operations management.

Based on the maximum hydraulic radiuses shown in Table 51, stope length and mucking efficiency from Caribou Mine's experience, SRK recommends that maximum stope dimensions be as follows:

- 20 m long (along strike for mineralization width less than 10 to15 m; transverse to the strike for mineralization width greater than 10 to15 m)
- 20 m wide
- 20 m in height (fixed, except Uppers used in the extremity of the strike)

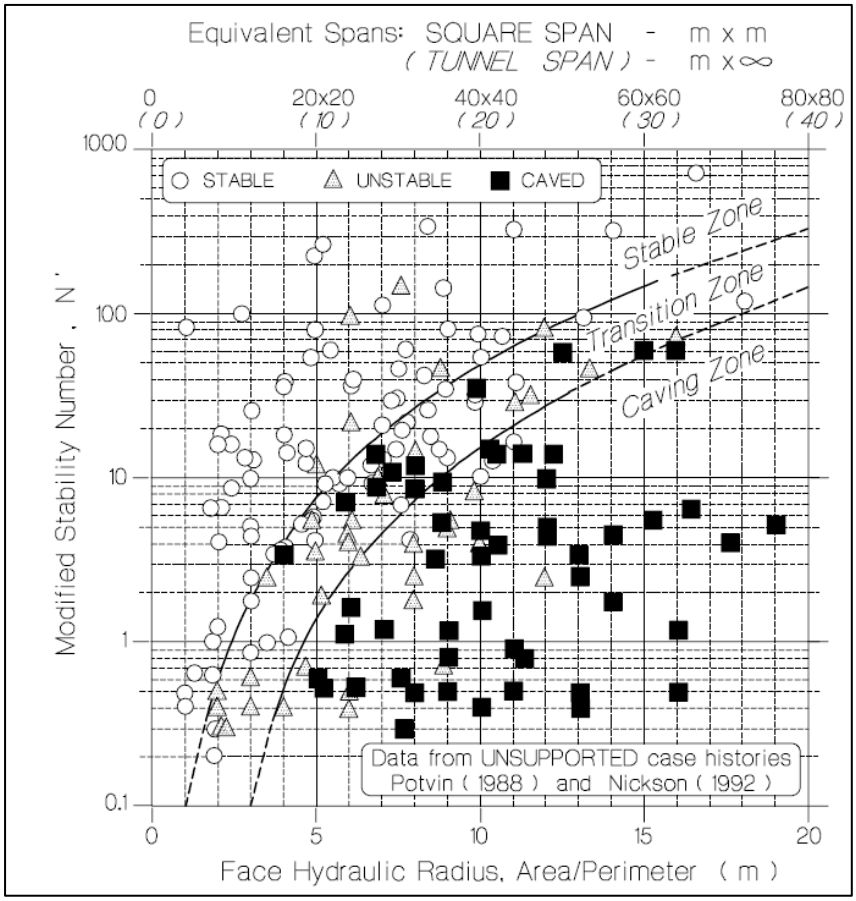


Figure 44: Modified Stability Graph to Assess Halfmile and Stratmat Project Open Stope Dimensions

Table 51: Halfmile Project Estimated Maximum Hydraulic Radius on Stope Rock Faces

	Q'	N'	HR*
HW	7.3	8.8	5.5
MS	28.6	34.3	9
FW	43.2	51.8	10.2

* m, without Support

Development Support Guidelines

Development will be located in the FW domain. There were no significant ground control issues during 2011 to 2012 trial mining development, and it is anticipated that there will be no significant challenges in the future mine development. Opening dimensions and support in nominal ranges of 5 to 7 m with 1.8 m rebar and mesh support should be considered acceptable at this time. Intersections up to 10 m should be supported with secondary or longer bolt support and minimum 2.4 m rebar in the back.

Support Analysis

Support was only analyzed empirically at this time. The Grimstad and Barton (1993) database was used to assess support requirements as shown in Figure 45. It indicates systematic bolting with

lengths in the range of 2.1 to 2.4 m at spacing of 1.5 m. It also indicates that shotcrete may be required if adverse ground conditions are met.

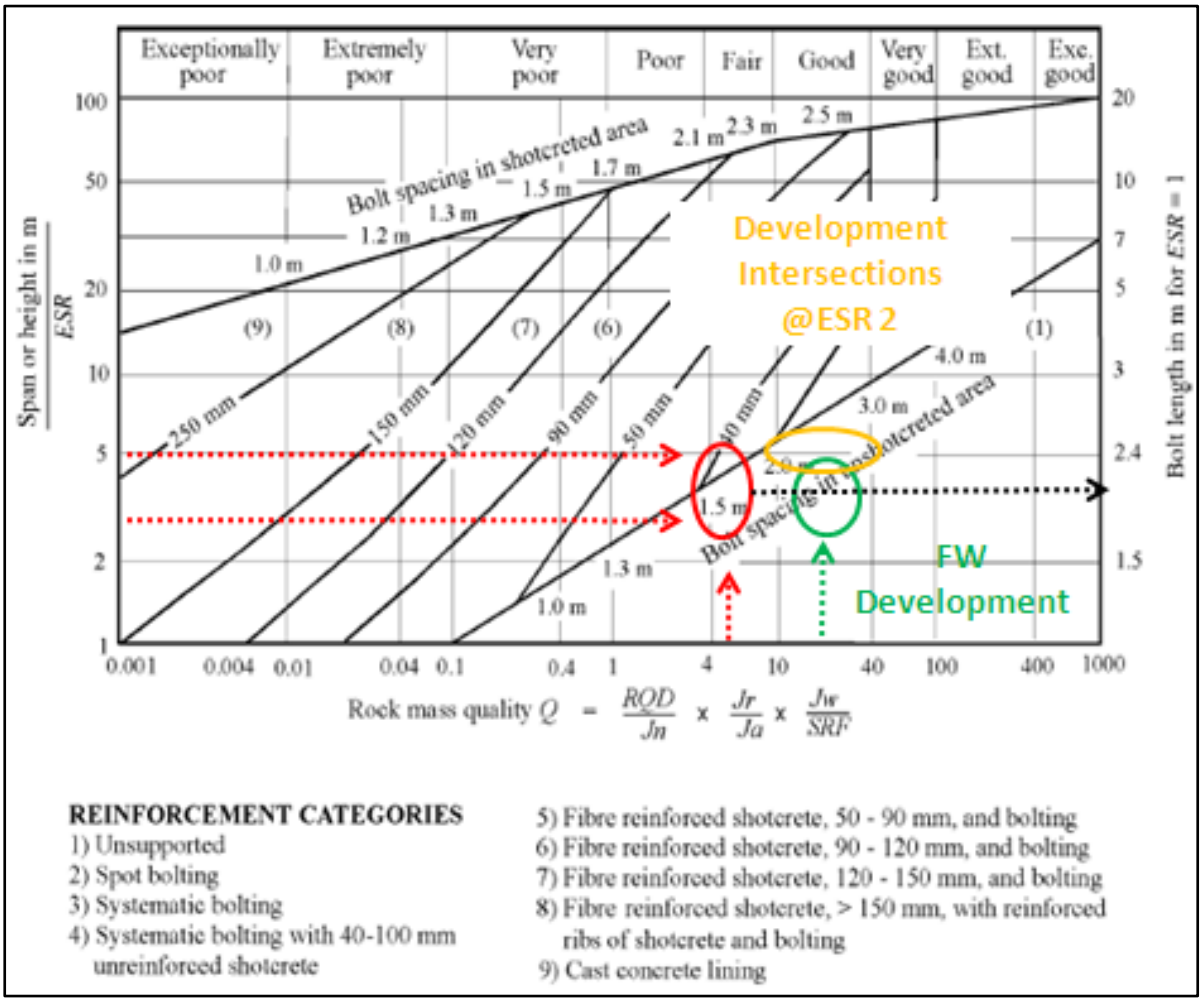


Figure 45: Support Guidelines (Hutchinson and Diederichs 1996)

Table 52 shows a summary of the ground support recommendations.

Table 52: Ground Support Recommendations

PPCF Stope Support	2.4 m long and 19 mm diameter fully grouted rebar on 1.2 m pattern Screen 10 x 10 cm, #6 gage weld wire mesh to 1.8 m from the floor
Development Support Drifting	1.8 m long 19 mm diameter fully grouted rebar on 1.2 m pattern Screen 10 x 10 cm, #6 gage weld wire mesh to 1.8 m from the floor
Development Intersections	2.4 m long and 19 mm diameter fully grouted rebar on 1.2 m pattern in the back Screen 10 x 10 cm, #6 gage weld wire mesh

The above recommendations are preliminary, and empirically and experienced based. Once the rock strength lab data are finalized a more analytical support assessment can be made.

15.2.2 Stratmat Project Geotechnical

Stratmat Project Structural Geology

The Stratmat project is underlain by a northeast-southwest trending sequence of predominantly felsic volcanic rocks and lesser sedimentary rocks. Coeval foliated gabbro intrusive rocks are evident in part of the east areas of the deposit, namely Main zone. Discordant diabase dykes intrude western portion of the project area with many aligned parallel to or along east-southeast trending structures.

Structurally, the Stratmat project is highly complex on the mine scale.

Fault System

Two constant fault orientations have been documented (Figure 7, Figure 46):

- The Stratmat fault trends east-northeast.
- Periodic east-southeast trending faults are observed.
- A major pivot or scissor fault crosses the baseline approximately at coordinate of 12300E.

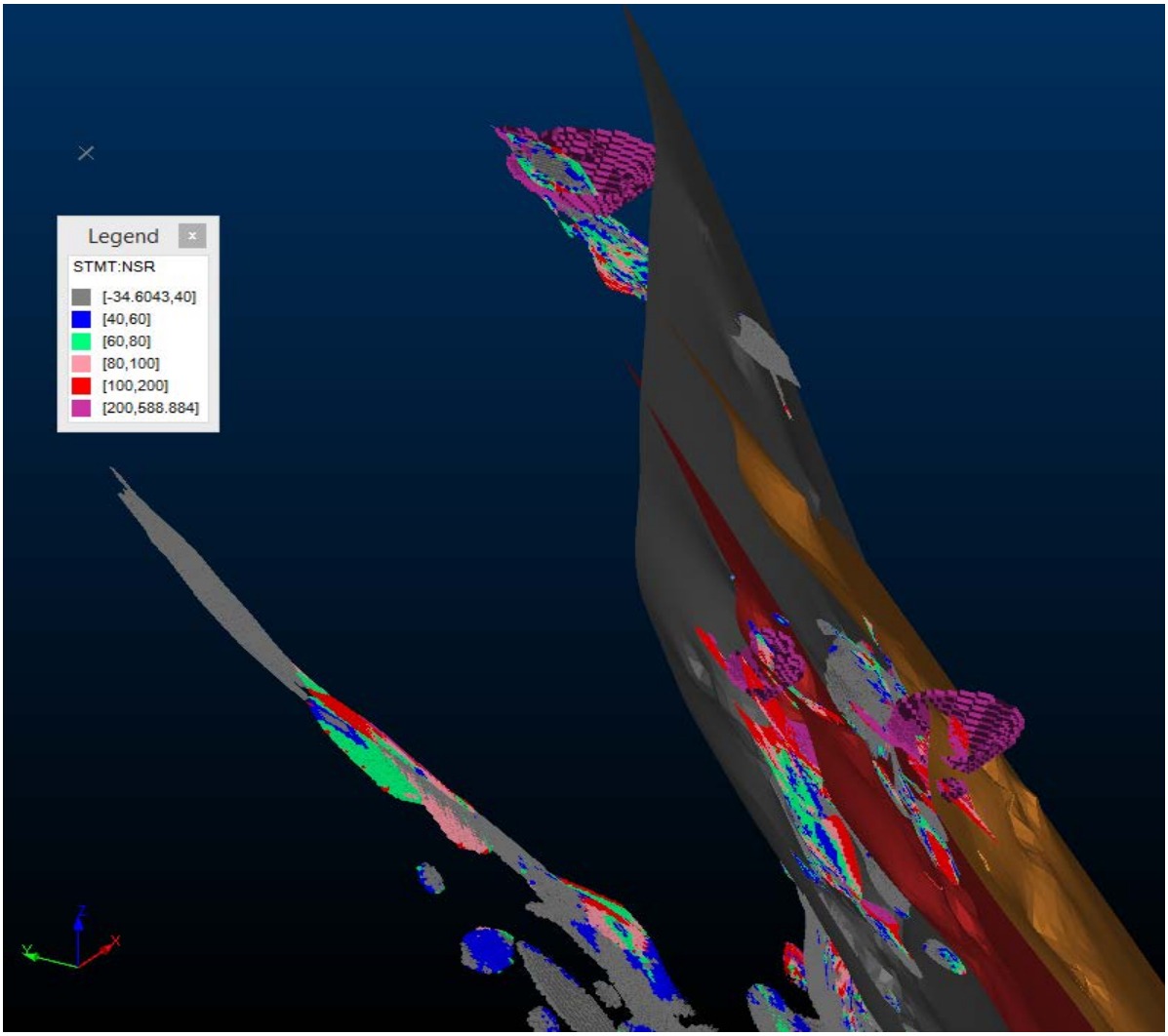


Figure 46: The Major Pivot or Scissor Fault Crossing the Baseline at Approximately 12300E

Stratmat Project Simplified Geotechnical Domains

Base on geological core logs (including borehole ST-711, 712, 713, 715, 716, 717, 718, 719, 720, 721, 722, 723, 725, 726, and 727) and geotechnical orientation core logs (including boreholes ST-728, 729, 730, and 731), preliminary geotechnical domains from mining geotechnical perspective can be classified as:

- MS – massive sulphide
- NSS - near solid sulphide (not the major focus on the PEA mine planning area)
- FW – dacite/gabrro/phyllite
- HW – dacite/gabrro/phyllite

Although it is impossible to determine orientation of the major discontinuities due to lack of beta angle recorded in the four geotechnical orientation core loggings, the major foliations seem dipping in the range of 45 to 75°.

Stratmat Project Preliminary Rock Mass Classification

Table 53 shows the properties derived for the rock geotechnical domains. There were only minor adjustments to the RQD values from the preliminary report.

Table 53: Stratmat Project Preliminary Rock Mass Clarification

	Massive Sulphide	HW/FW Dacite	HW/FW Phyllite	HW/FW Waste Overall
RQD	84	75	57	75
GSI	66	50	38	46
RMR_{89}	58	50	43	49
Q*	5.0	2.0	0.9	1.8

* Q was converted using formula Q = exp ((RMR89 - 44)/9) (Bieniawski 1989)

Stratmat Project Sublevel Open Stope Dimension Analysis

Sublevel open stope (SLOS) with backfill (CRF for primary stope and RF for secondary stope) was selected as preferred underground mining methods for the majority of S1 Deep zone and S0 zone mineralizations where the mineralizations have horseshoe shapes and varied width from a few meters to more than 30 m and dipping angle amenable to longhole open stope mining. For the narrower and isolated veins such as Mainzone and S1 Shallow zone, modified Avoca and/or longitudinal SLOS is preferred.

The SLOS and modified Avoca stope dimension analysis was based on rock mass properties shown in Table 53 and modified stability graph method (Potvin 1988), as shown in Figure 44. Due to lack of detailed joint sets and their orientations as well as in situ stress information, derived factors from Caribou Mine were used to estimate rock stress factor (A), joint orientation factor (B), gravity adjustment factor (C), thus modified stability graph number (N').

Table 54 shows the estimated maximum hydraulic radius for different rock faces of the open stope without additional ground support.

Stope height trade-off study (15, 20, and 25 m in heights) shows that a 20-m high stope provides more economical results, considering internal dilution, potential external, NSR, capital and operating development and associated costs, cemented backfill strength requirement and associated cost, and ease of operations management.

Based on the hydraulic radiuses shown in Table 54, stope length and mucking efficiency from Caribou Mine's experience, SRK recommends that maximum stope dimensions are:

- (10−15) m long x (15−20) m wide x 20 m in height
- Typical stope dimensions: 15 m long x 12 m wide x 20 m in height

Table 54: Stratmat Estimated Maximum Hydraulic Radius for Stope Rock Faces

	Q'	N'	HR*
HW/FW (Dacite)	6.7	8.0	5.0
HW/FW (Phyllite)	2.3	2.8	3.2
MS	6.7	8.0	5.7

* m, without Support

15.3 Block Models and Net Smelter Return Estimation

15.3.1 Block Models Used in Mine Planning

For the Halfmile project, the mine planning work was based on an updated block model completed by SRK in 2016 (part of this PEA); for Stratmat project, the mine planning work was based on an updated block model completed by SRK in 2015, see Section 13 for details.

15.3.2 NSR Calculation

In the PEA, SRK used a net smelter return value as an indicator to determine if a mining shape/stope met the economic cut-off criteria for inclusion into the mining plan. The same NSR calculation was used for both the Stratmat and Halfmile projects and incorporated in the resource block models for mine planning. Table 55 shows the assumptions and parameters used in the NSR calculations. The NSR models were generated to capture all of the metal credits for Halfmile and Stratmat RoM materials and to account for metal recovery and off-site costs. Therefore, the in situ NSR value was calculated for each mineralized block in the mineral resource block models using the metal prices, process recoveries, and metal payable terms summarized in Table 55.

For the purposes of block model NSR estimation, metal prices for zinc, lead, copper, silver, and gold and exchange rate were based on consensus forecasts (Table 55). Process recoveries were based on initial estimated at the beginning of the PEA project. Metal payables were based indsutry standard benchmarks, and off-site cost was based on Caribou operations' Q1 2016 data. It should be noted that gold credit was not accounted in the NSR models.

The in situ NSR value is calculated as follows:

NSR(C$/t) = 19.1443*ZN(%)+14.7421*PB(%)+42.7683*CU(%)+0.2834*AG(g/t)-34.63(C$/t)

Table 55: Parameters Used in NSR Calculation

Item	Unit	NSR Metal Price US$	NSR Metal Price C$	Process Recovery	Payable Accountability
Zinc	$/lb	1.01	1.20	85%	85%
Lead	$/lb	0.91	1.08	65%	95%
Copper	$/lb	2.86	3.40	60%	95%
Silver	$/oz	17.33	20.62	45%	95%
Gold	$/oz	1,201.00	1,429.19	-	-
Exchange rate	US$/C$	0.84			
Off-site cost	$/t RoM		34.63		

15.4 Halfmile Project Planned Mining Methods

The Halfmile portion of the Halfmile-Stratmat integrated project consists of a ramp access underground mine with a mine life of 13 years accessed from an existing portal. The maximum underground production rate is set at 0.91 million tonnes per annum (Mtpa), or 2,600 tonnes per day (t/d) except for the years 2028 and 2029. Additional development has been scheduled prior to these years in order to develop enough stopes to allow the mine to produce at 0.98 Mtpa , or 2,800 t/d for those two years in order to offset the effect of the Stratmat Mine closing. This effort can only be maintained for a short time before the Halfmile Mine production starts to taper off as the currently defined resources are exhausted

The local mine grid, which corresponds to historical mine site used term, is based on NAD 83 UTM coordinates:

- Northing = UTM Northing minus 702,000 m
- Easting = UTM Easting minus 5,243,000 m
- Elevation = UTM elevation plus 5,000 m

15.4.1 Past Mining

The Halfmile Mine has been on care and maintenance since mid-2012 when the trial mining (bulk sample) and toll milling program were completed. At that time, the temporary surface facilities were removed. Since then, a 20 MBTU mine air heating unit and a 350 horsepower (hp) variable speed ventilation fan used during the trial mining have been removed and relocated to the Caribou Mine.

15.4.2 Mine Rehabilitation

SRK visited the Halfmile Mine site in July 2015 and May 2016. The routine care and maintenance program has kept the site and remaining infrastructure in reasonable condition. Trevali site personnel told SRK that the underground dewatering system worked well at the time and automatically started and stopped as needed based on the water level in the underground sumps.

SRK assumes that the rehabilitation work to reopen the underground mine will be light. The estimated mine rehabilitation to re-activate the mine is approximately 30 days, and cost required has been budgeted in the mine plan.

15.4.3 Proposed Mining Methods

Mining Context

The relevant characteristics of the Halfmile project from a mining method selection perspective are provided below.

- Massive sulphide polymetallic deposit consisting of five known zones.
- The Upper zone has a flat dip of 35°, variable strike direction and horizontal widths up to 30 m.
- The Lower zone is a very complex with three distinct areas (the hinge, the upper limb and the lower limb) forming a wishbone-like shape in plan view.
- The Lower zone has a steeper dip then the Upper zone, averaging 50 to 60°. The strike direction is highly variable and horizontal widths range from 3 to 35 m, averaging 16 m in the economic portions.
- The Deep zone is flatter than the Lower zone, averaging 35 to 55° with a more regular NE-SW strike. Horizontal widths range from 3 to 60 m, averaging 31 m in the economic portions.
- The continuity of the Upper zone and Deep zone at the appropriate cutoff value (CoV) is relatively good; the Lower zone shows less continuity.
- The South and North zones are not included in the current LoM plan.
- All of the Measured resources with the highest confidence level are contained in the Upper zone around the trial mining area.
- The Lower zone is 75% Indicated resources, 25% Inferred resources.
- The Deep zone is all Inferred resources.
- Waste rocks at the Halfmile project site are potential acid generating (PAG) rocks.
- RoM materials will be trucked approximately 22 km from the Halfmile site to the proposed Stratmat DMS plant, where DMS economic product (pre-conditioned mill feed) will either treated in the Stratmal Mill for the base case and/or trucked to the Caribou mill for processing in the alternative case.
- To maximize recovery of the resource, cemented waste rock fill (CRF) in conjunction with waste rock fill (RF) has been proposed. To satisfy environmental requirements, a cement silo and a simple cement slurry mixing plant will be set up underground. Waste rock shortage for backfill from Halfmile underground development will be supplemented by backhauling waste rock and Dense Media Seperation (DMS) rejects from the Stratmat site.
- Backfill would consist of approximately one third RF and two thirds CRF.

Mining Methods

Due to the complex geometry and variability in strike and dip, the development of a tool box of mining methods is recommended in order to maximize extraction of the Halfmile project.

Post Pillar Cut and Fill

The Upper zone will mainly be extracted using the post pillar cut and fill (PPCF) method, utilized in 2012 for the trial mining, see Figure 47. This will be supplemented by mechanized cut and fill method in narrower sections, see next section (Figure 48). Levels are nominally on a 30-metre vertical spacing with each level accessing up to five 5-metre high cuts. Backfill in this area will be largely unconsolidated RF, though use of CRF has been proposed for the initial lift of each mining front to allow for sill pillar recovery and to provide better working floors. The two sill pillars established in 2012 will not be recoverable.

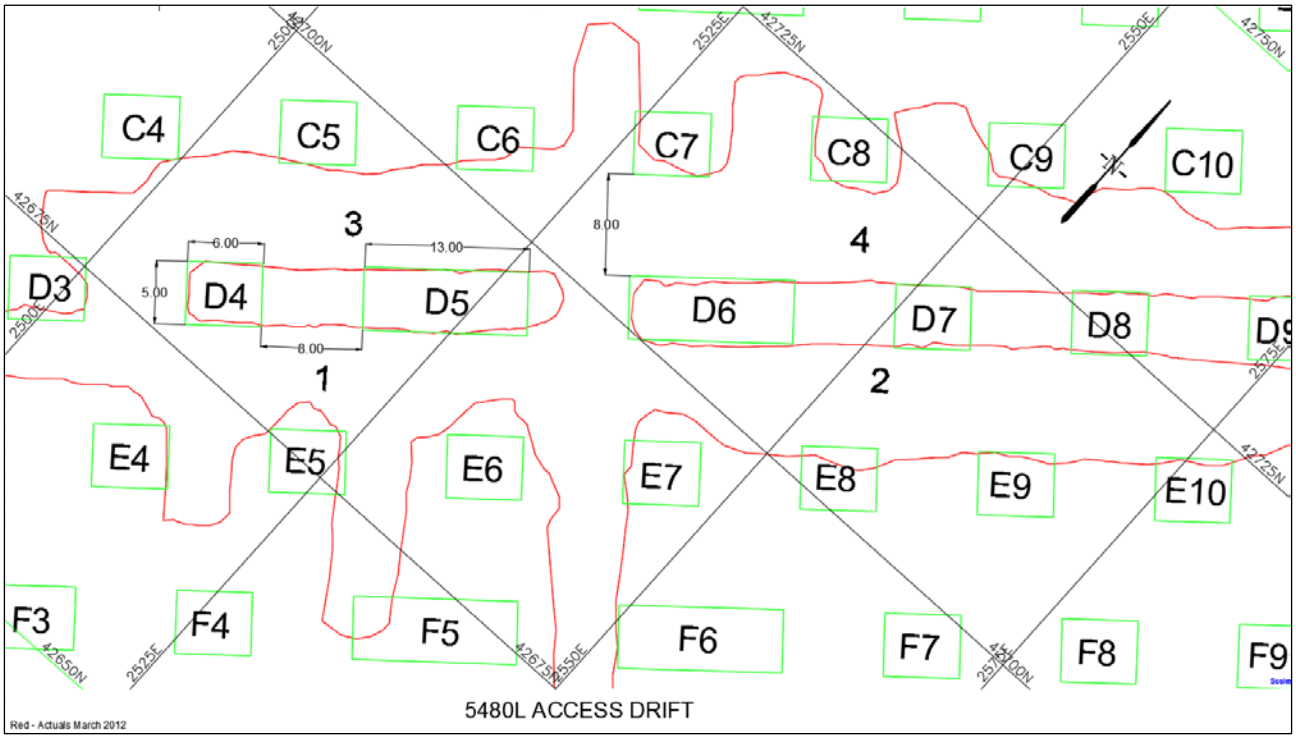


Figure 47: Pillar Layout and Naming Convention (Trevali 2012)

Most lifts are designed with 5 m high x 8 m wide rooms with 13 x 5 m barrier pillars either side of the access drift (Pillars D5 & D6 in Figure 47), and 6 x 5 m standard pillars. This pillar layout shown in Figure 47 was developed for the 2012 trial mining.

Backfill used during the 2012 trial mining was exclusively unconsolidated rock fill placed by load-haul-dump (LHD) and packed with a “Rammer Jammer” similar to the unit shown in Figure 49. This typically resulted in a working height in the stope of 6−7 meters.

The introduction of cemented backfill for the Lower and Deep zones presents several opportunities in the Upper zone that are not currently reflected in the mine plan. By filling the initial cut of each stoping block with a good quality cemented backfill, an additional 50–100 kt of mineralized materials could potentially be recovered from the 7 m thick sill pillars. Further geotechnical investigations and modelling would be required. The two sill pillars established in 2012 will not be recoverable as the initial lifts above the sill pillars are filled with unconsolidated rock fill.

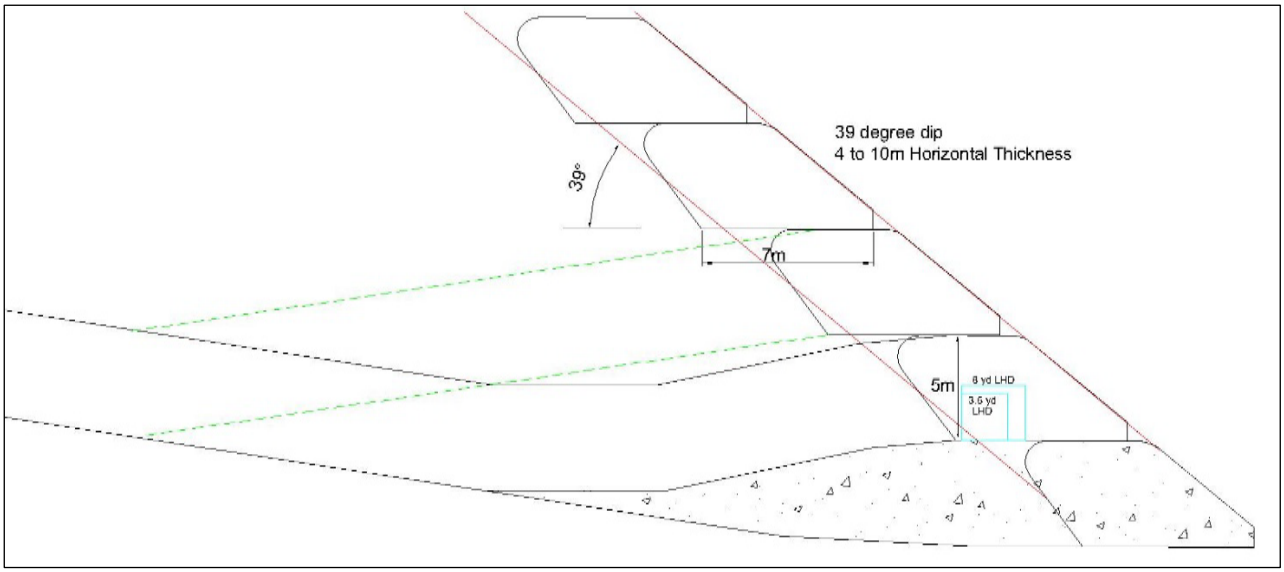


Figure 48: Conceptual MCF Drift Profile

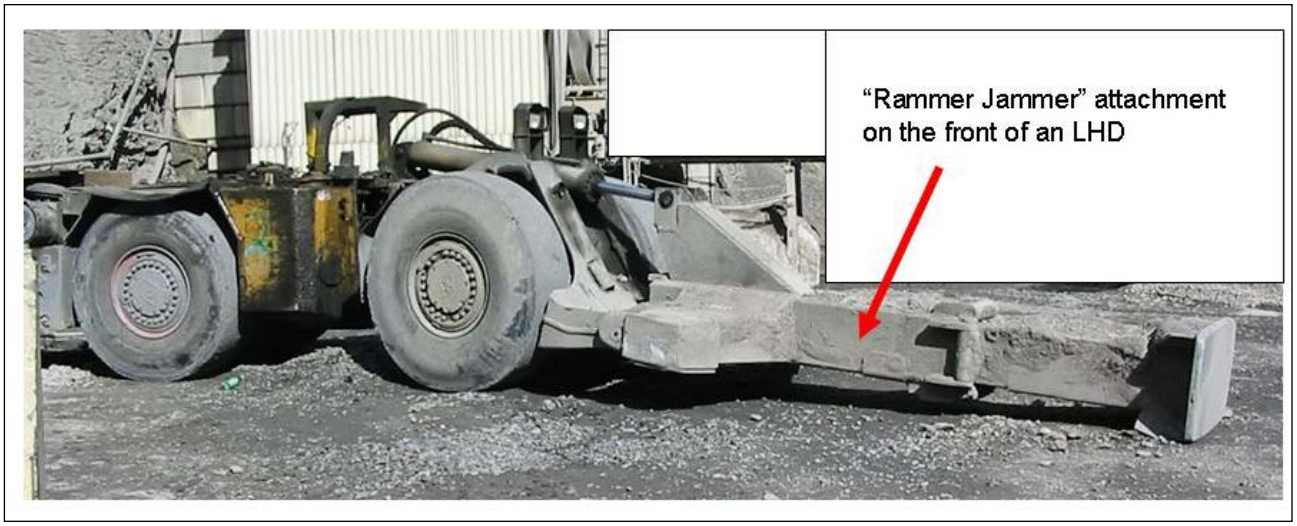


Figure 49: Example of a Rammer Jammer (SRK File Photo)

Mechanized Cut and Fill

Mechanized cut and fill (MCF) stopes above 5320L are extensions of the PPCF stopes where the Upper zone is less than 10 m horizontal width. One small area of the Lower zone on the 5180L was also designed as MCF.

The MCF stope design criteria are the same as the PPCF stopes except there are no pillars and a set of smaller mining equipment has been included in the equipment list to allow for more selective mining of these narrower stopes. The 8-yard class LHD used for development and production can operate in a 5.5 to 6 m wide MCF stope with a 39° dip, while a 3.5-yard class LHD could operate in a 4 m wide stope.

Transverse and Longitudinal Retreat Longhole

The Lower and Deep zones will tend to use transverse sublevel longhole open stope mining method (SLOS Figure 50) and longitudinal sublevel retreat longhole open stope mining method (SLR Figure 51) when the mineralization width is less than 10–15 m. A sub-level spacing of 20 m has been selected for these zones. Backfill for the transverse stopes would be CRF for primary stopes and CRF and/or RF for secondary stopes. Backfill for the longitudinal retreat stopes would be a mix of CRF with RF.

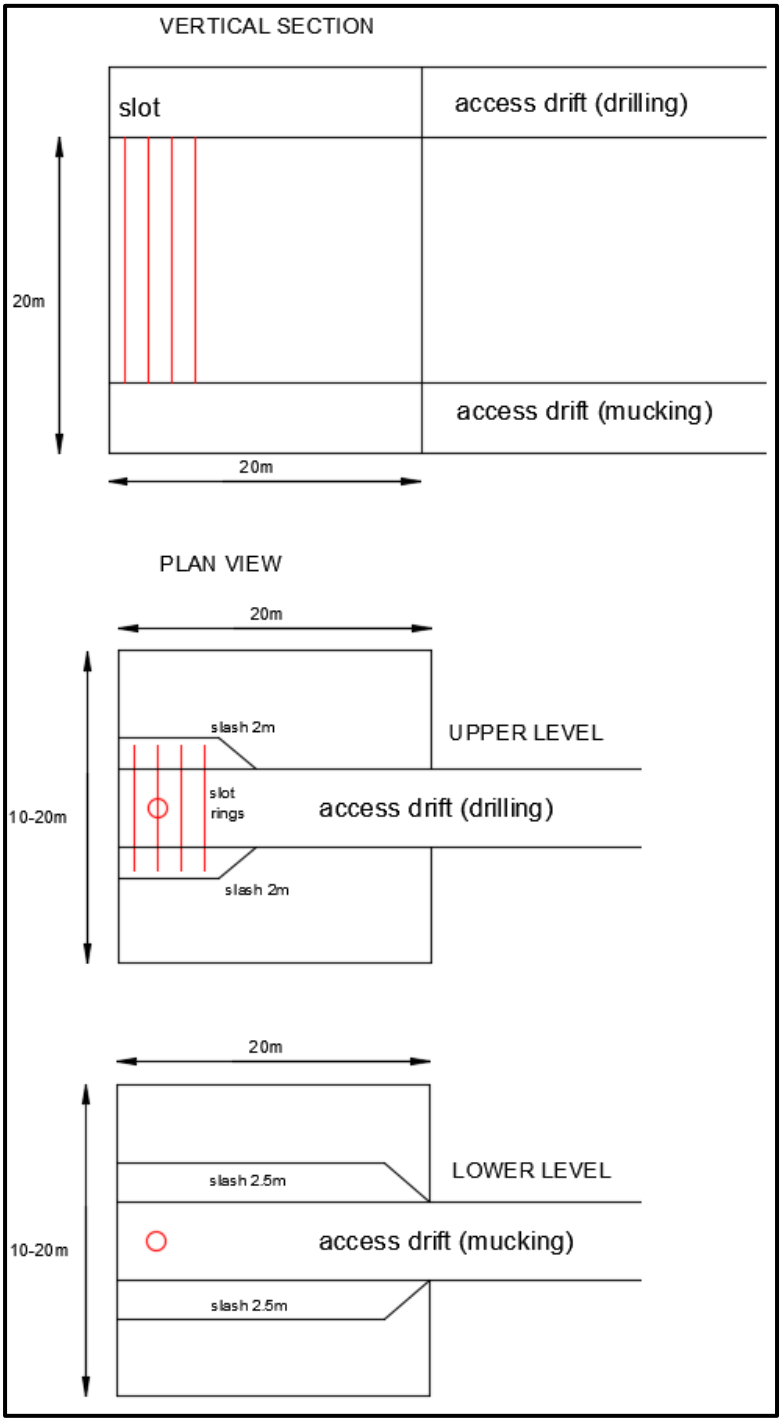


Figure 50: Conceptual Transverse Sublevel Open Stope

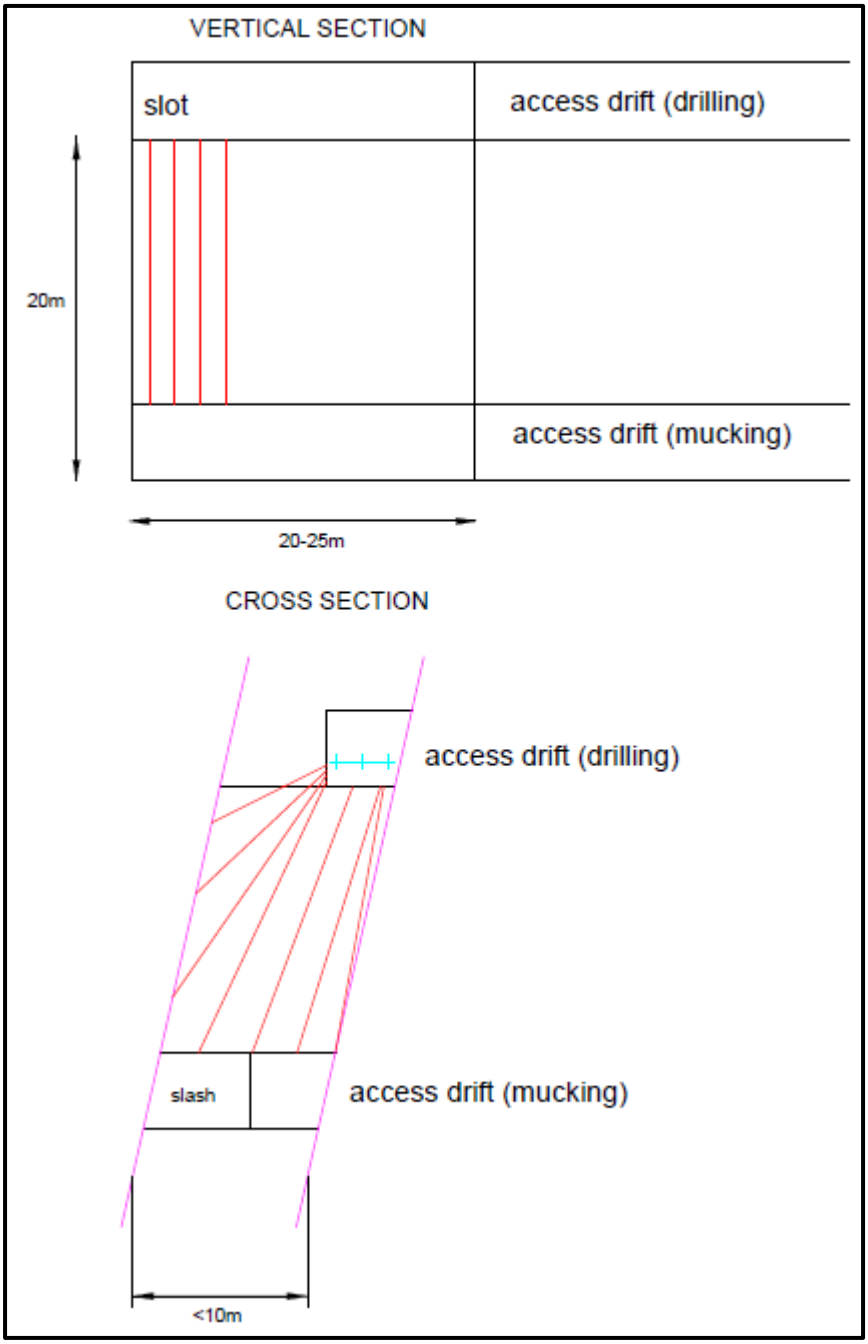


Figure 51: Conceptual Longitudinal Sublevel Open Stope

A modified Avoca method (Figure 52), could also be utilized in some areas of the Lower and Deep zones, instead of the more typical SLR. Modified Avoca is an alternative of longitudinal retreat mining method, which has been successfully implemented in Trevali's Caribou and Santander operations.

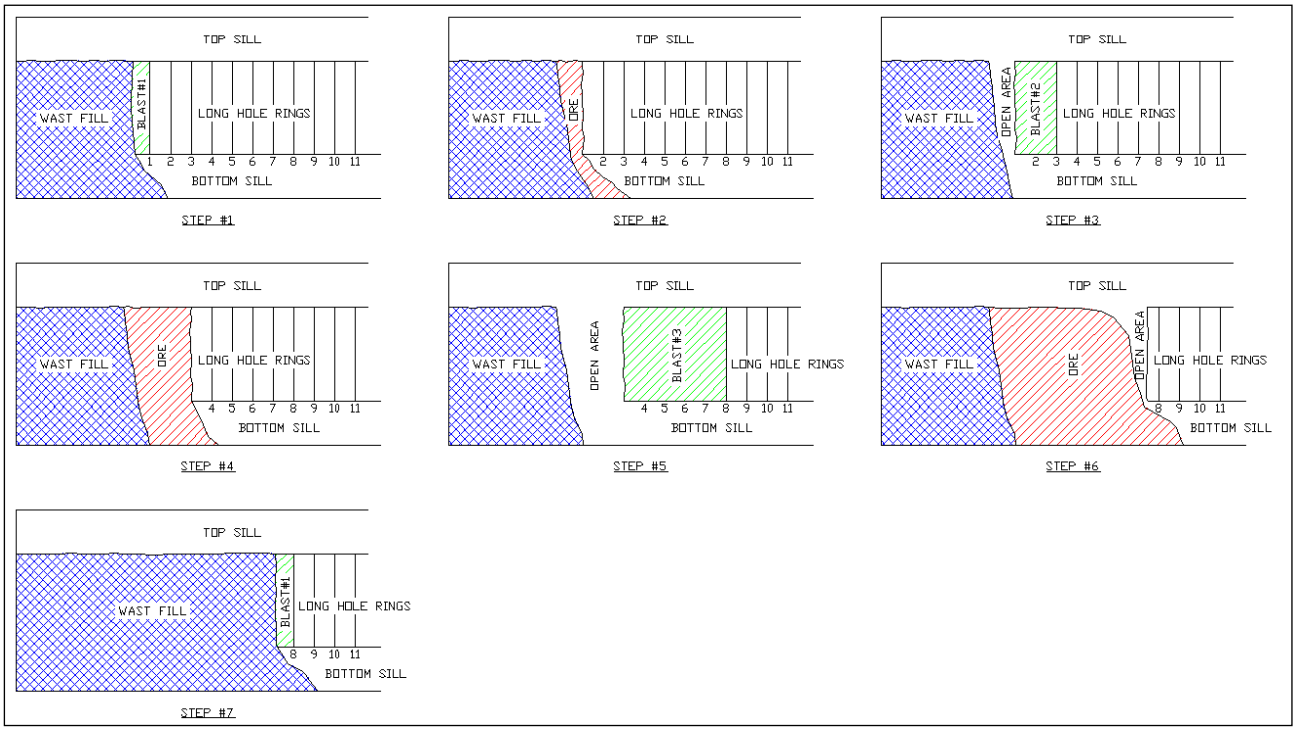


Figure 52: Modified Tight-Fill Avoca Mining Method and Blasting Sequence

Source: Trevali (2014)

15.5 Stratmat Project Planned Mining Methods

15.5.1 Mining Context

The relevant characteristics of the Stratmat projectfrom a mining method selection perspective are provided below.

- It is a VMS type of massive sulphide polymetallic deposit consisting of five known zones, namely Main zone or Zone 100, New zone or Zone 200, S0 zone or Zone 300, S5 zone or Zone 400, S1 Deep/Shallow zone or Zone 500/501 (Figure 15, Figure 19).
- The Main zone and S1 Shallow zone have the potential economic mineralization extending from near the surface down dip up to 300 m and 80 m below surface respectively.
- The upper limits of potential economic mineralization for S1 Deep, S0, S5, and New zones are below surface approximately 180 m, 640 m, 300 m, and 340 m respectively.
- On surface, the Main zone and S1 zone are approximately 750 m apart.
- The S1 Deep zone is the major potential economic mineralization lens with very complex shape both on plan view (Figure 53)and on section view (see Figure 22) due to complex folding within the S1 Deep zone.
- All zones have moderate to steep dipping angles on a 20 m stope height scale. Horizontal widths range from 3 m to more than 50 m.
- The continuities of the S1 Deep, S0, and S5 zones at the appropriate CoV are relatively good. The continuity of the Main zone has an approximately 100 m vertical gap at the appropriate CoV. The S1 Shallow zone at the appropriate CoV shows less continuity.

- The New zone is excluded in the current LoM plan due to less economic material and its isolation from other zones.
- Part of waste rocks at the Stratmat project are PAG rocks.
- RoM materials will be be directly trucked to the proposed Stratmat DMS plant, approximately 2 km from the Stratmat Mine site.
- To maximize recovery of the resource, CRF in conjunction with RF is proposed.
- Backfill would consist of approximately one-third RF and two-thirds CRF.

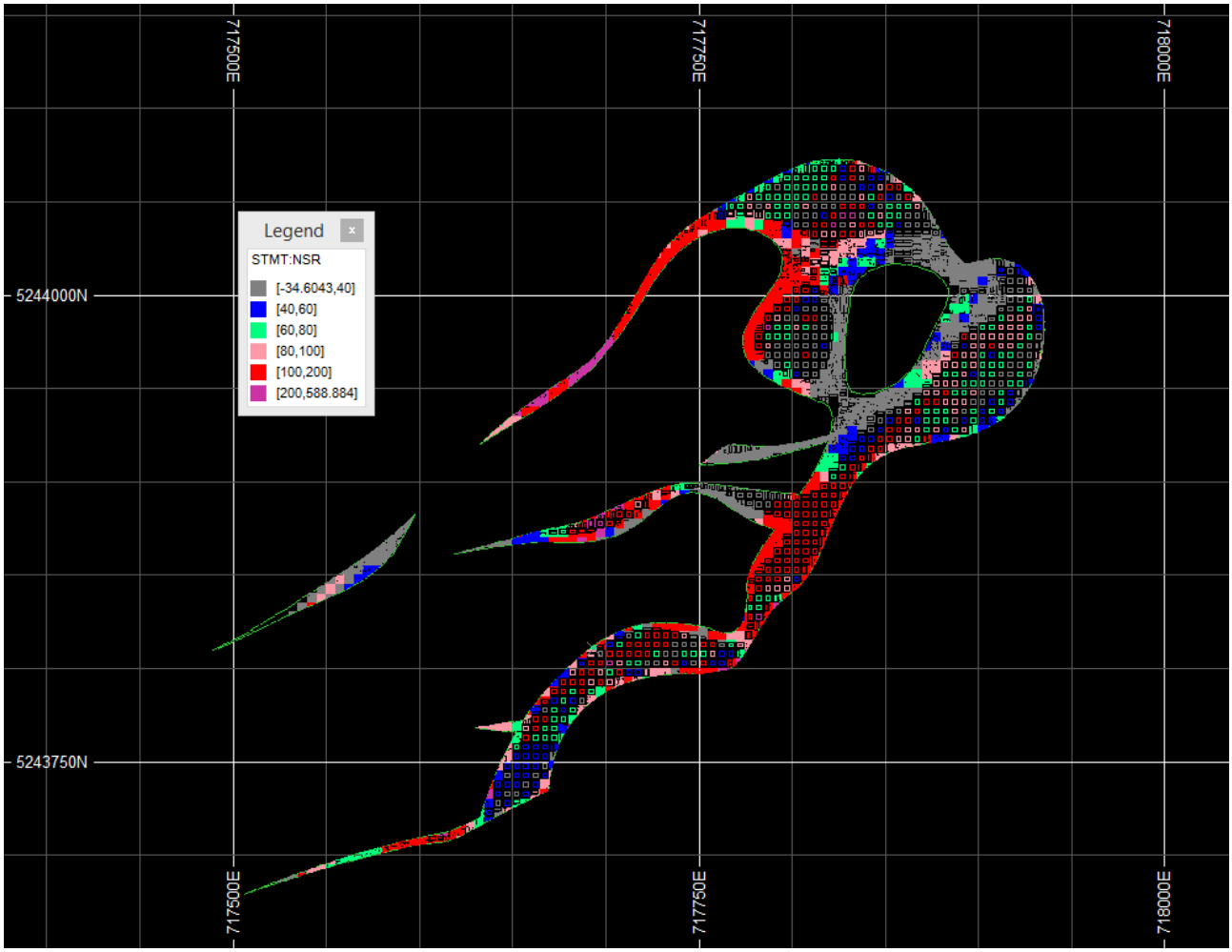


Figure 53: Complex Shape of S1 Deep Zone - Plan View at Elevation -120m

15.5.2 Proposed Mining Methods

Due to the complex geometry and variability in strike and dip, the development of a tool box of mining methods is recommended in order to maximize extraction of the Stratmat project.

The most of the S1 Deep zone will tend to use transverse SLOS) (Figure 50) supplemented with longitudinal SLR open stope mining method (Figure 51) when mineralization width is less than 8–12 m. All other zones will be mining using SLR. A small portion of mineralization can be mined using Uppers such as relatively isolated stope and extremity of strike length. A sub-level spacing of 20 m has been selected for these zones. Backfill for the transverse stopes would be CRF for primary stopes

and RF and/or CRF for secondary stopes. Backfill for the longitudinal retreat stopes would be a mix of CRF with RF.

A modified Avoca method (Figure 52) could also be utilized in some areas of the Main zone and S1 Shallow zone, instead of the more typical SLR. Modified Avoca is an alternative of longitudinal retreat mining method, which has been successfully implemented in Trevali's Caribou and Santander operations.

15.6 Halfmile Project Potential Run-of-Mine Material Estimate

15.6.1 Halfmile Project Block Models Used in Mine Planning

The mine planning work was based on an updated block model completed by SRK in 2016, as described in Sections 13.13 and 13.17. The original GEOVIA GEMS block model used for resource estimates was converted to a Datamine format subcelled block model and validated prior to the start of mine planning.

15.6.2 Halfmile Project Initial Cut-off Value (CoV)

Table 56 represents an early estimate of the underground NSR CoV supporting the selection of $76/t NSR and $87/t NSR as the RoM CoV for longhole and cut and fill mining methods respectively. After applying allowances for internal and external dilution, an in situ CoV of approximately $85/t NSR for longhole mining and $100/t NSR for cut and fill mining were estimated as the cut-off criterion for targeting blocks in the resource block model when designing mining shapes for the Halfmile project.

Table 56: Initial NSR Cut-off Value Estimation

Item	Unit	Cut & Fill	Longhole
U/G Production Rate Estimate	tpd	1,200	2,600
Mining Operating Cost	C$/t	57.99	46.53
Milling Operating Cost	C$/t	20.57	20.57
G&A Cost	C$/t	7.02	7.02
Environmental Cost	C$/t	1.54	1.54
Site Total Operating Cost/Tonne RoM	C$/t	**87.32**	**75.66**
Royalty	C$/t	2.8	2.43
RoM NSR CoV	C$/t	**90.12**	**78.09**
External Dilution		15%	12%
Inside Mining Shape	C$/t	**100**	**85**
Internal dilution	Included in Stope Shapes		
Block Model In Situ CoV (Target)	C$/t	**100**	**85**

The table shows the initial estimates of the site milling rate, underground mining rate, and associated site operating cost, and royalties. These costs were based on:

- Mining, milling, G&A, environmental costs were based on preliminary cost modelling from Caribou's Q1 2016 actual data, and factored by Trevali, SRK, and Holland. SRK compared the factored data with internal database benchmarked data.
- NSR value based on Section 15.3.2 discussed.
- 2% royalties held by Glencore on the Halfmile project.
- Estimates of internal and external dilutions were based on the results of Trevali initial stope design work for Stratmat and an external dilution assessment undertaken by SRK.

In this study, external dilution is defined as unplanned waste material divided by undiluted economic material (dilution = W/O x 100%).

15.6.3 Stope Design

Post Pillar Cut and Fill

The PPCF stopes in the Upper zone were designed manually based on existing design criteria in Datamine Studio 5DP by treating the stope development the same as lateral development. This was done in order to mimic the shapes developed during the 2012 trial mining such that both the internal and external dilution are modelled in the stope shapes.

Mechanized Cut and Fill

The MCF stopes were designed manually based on the existing design criteria in Datamine Studio 5DP by outlining the economic portions of the Upper zone at the floor and back elevations. This results in a stope solid that includes the internal dilution.

Transverse and Longitudinal Retreat Longhole

For the Lower, Deep, South and North zones, Mineable Shape Optimizer (MSO), an optimization module integrated with Datamine Studio 5DP, was used to analyze various factors such as sublevel spacing and CoV to determine the optimal overall design for each zone. The run that best represented the probably real world results was then cleaned up and used in the development of the LoM plan, see Figure 54. MSO results include internal dilution. There is considerable opportunity to optimize these results in the future as more information becomes available.

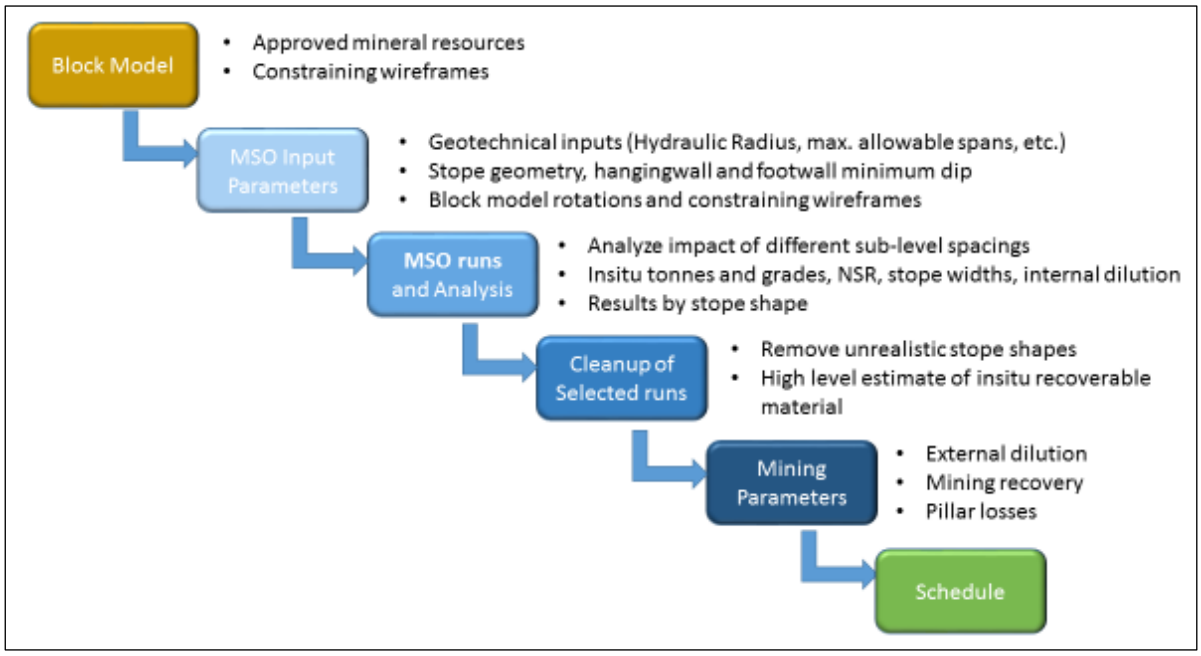


Figure 54: MSO Assisted Design Method

15.6.4 Dilution Assessment and Mining Recovery Parameters

As no historical data was available for the Halfmile project on external dilution and mining recoveries achieved during the 2012 trial mining, based on preliminary stability analysis, external dilution assessment, and Caribou Mines reference data, SRK made the following assumptions.

- Internal dilution for all zones is included within the stope wireframes and reported from the block model.
- External dilution was modelled for the PPCF stopes of the Upper zone only. All other zones and mining methods have external dilution added manually (Table 57).

External dilution is defined as unplanned waste tonnes/planned economic material tonnes (W/O).

Table 57: Halfmile External Dilution

Mining Method	Internal Dilution	External Dilution	Mining Recovery
Post Pillar Cut and Fill	Included in mining shapes	17%*	98%
Mechanized Cut and Fill	Included in mining shapes	12%	98%
Lower Zone Longhole	Included in mining shapes	12%	95%
Deep Zone Longhole	Included in mining shapes	12%	95%

* Reported from block model

SRK notes:

- Internal dilution for the PPCF stopes is higher than other methods as the fixed configurations of pillars force some rooms to skirt the FW or HW, or pass through lower grade zones in order to access valuable economic material beyond.
- For the PPCF stopes, the external dilution includes 15% within the stope design wireframe plus 2% backfill dilution from mucking.
- For the PPCF stopes, the mining recovery does not account for the permanent pillars as these are excluded from the stope design wireframe, just the recovery of the planned stopes.
- Internal dilution for the Lower zone is higher as this is a very complex area, basically wishbone shaped with rapidly changing strike and dip which forces MSO to include additional material. MSO runs were done in three sections: hinge area, lower and upper limbs. Each area required different parameters in MSO to achieve a reasonable result. There is considerable opportunity to optimize these mining shapes in the future.
- External dilution for all mining methods other than PPCF was set to 12% at a $25 NSR (1% zinc, 0.4% lead). The external dilutions were set at 12% because an external dilution assessment was made at Stratmat and it is assumed they are the same.

15.6.5 Halfmile Potential RoM Material for Mine Plan

Table 58 shows how the in situ mineralized material contained inside planned mining shapes converted to potential mining resources or run-of-mine (RoM) material. NSR values are calculated using the assumptions and parameters shown in Table 55.

Table 58: Estimation of Underground Mining Resource for Halfmile Mine Plan

Category	Potential Mining Resources for Mine Plan						
	Tonnes (kt)	Zn (%)	Pb (%)	Cu (%)	Ag (g/t)	Au (g/t)	NSR ($/t)
Measured	155	6.06	2.12	0.44	39.46	0.63	143
Indicated	5,592	6.22	2.18	0.11	32.27	0.25	136
Subtotal of Measured and Indicated	**5,747**	**6.21**	**2.18**	**0.12**	**32.46**	**0.26**	**136**
Inferred	3,629	5.33	1.49	0.12	21.80	0.09	105
Subtotal of Inferred	**3,629**	**5.33**	**1.49**	**0.12**	**21.80**	**0.09**	**105**

* Figures have been rounded.

** The estimated RoM is partly based on Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the preliminary economic assessment based on these mineral resources will be realized.

*** The reader is cautioned that the mineralized material should not be misconstrued as a mineral resource or a mineral reserve. The quantities and grade estimates are derived from the block model and include mining dilution and losses.

It should be noted that the Halfmile potential mining resources for the mine plan are not the same as Halfmile potential plant feed. The potential mining resources for the mine plan refer to the quantity and grades (NSR) of the mineral resources from mining development and stope production. The plant feed refers to the mining resources sent to the mill for processing. At a normal mine production scenario, these two are identical; however, due to a DMS plant that will be installed at Stratmat surface, these two terms refer to different mineral resource tonnes and grades. The Halfmile (and Stratmat) potential plant feed will be discussed in details in Section 15.12.

Table 59 shows the mineral resources that were not included in the current mine plan.

Table 59: Mineral Resources Not Included in the Mine Plan in Halfmile

Category	Mining Resources Not Included in Mine Plan						
	Tonnes (kt)	Zn (%)	Pb (%)	Cu (%)	Ag (g/t)	Au (g/t)	NSR ($/t)
Measured	256	5.85	1.92	0.48	39.54	0.55	137
Indicated	2,308	6.10	1.90	0.24	27.08	0.25	128
Subtotal of Measured and Indicated	**2,563**	**6.07**	**1.90**	**0.27**	**28.32**	**0.28**	**129**
Inferred	3,022	5.41	1.44	0.14	29.01	0.12	102
Subtotal of Inferred	**3,022**	**5.41**	**1.44**	**0.14**	**20.01**	**0.12**	**102**

* There are potential rounding errors in subtotal and total numbers.

** Values calculated using an NSR CoV of $95/t.

*** The mineral resources listed above include Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves.

**** Part of the mineral resources are located in the North zone which is excluded in the current study as guided by Trevali; part of the mineral resources are removed from the current mine plan due to shortage of backfill material to fill fill up mined voids.

15.7 Stratmat Project Potential Run-of-Mine Material Estimate

The methodology of the Stratmat plant feed estimate is similar to the Halfmile potential mining RoM plan from the longhole mining.

15.7.1 Stratmat Project Block Models Used in Mine Planning

The mine planning work was based on an updated block model completed by SRK in 2015, as described in Sections 13.14 and 13.18. The original GEOVIA GEMS block model used for resource estimates was converted to Datamine format subcelled block model and validated prior to the start of mine planning.

15.7.2 Stratmat Project Initial Cut-off Value (CoV)

Table 60 represents an early estimate of the underground NSR CoV supporting the selection of $80/t NSR as a guide for the plant feed CoV. After applying allowances for internal and external dilution, an in situ CoV of approximately $85/t NSR for longhole mining was estimated as the cut-off criterion for targeting blocks in the resource block model when designing mining shapes for the Halfmile underground mine.

The table shows the initial estimates of the site milling rate, underground mining rate, and associated site operating cost, and royalties. These costs were based on:

- Mining, milling, G&A, environmental costs were based on preliminary cost modelling from Caribou's Q1 2016 actual data, and factored by Trevali, SRK, and Holland. SRK compared the factored data with internal database benchmarked data.
- NSR value based on Section 15.3.2 discussed.
- 2% royalties held by Glencore on the Stratmat project.
- Estimates of internal and external dilutions were based on the results of Trevali initial stope design work for Stratmat and an external dilution assessment undertaken by SRK.

In this study external dilution is defined as unplanned waste material divided by undiluted economic material (dilution = W/O x 100%).

Table 60: Stratmat Initial NSR Cut-off Value Estimation

Item	Unit		Longhole
U/G Production Rate Estimate	t/d		1,400
Mining Operating Cost	C$/t		39.51
Milling Operating Cost	C$/t		20.57
G&A Cost	C$/t		7.02
Environmental Cost	C$/t		1.54
Site Total Operating Cost/Tonne RoM	C$/t		**68.64**
Royalty	C$/t		4.55
Plant Feed NSR CoV	C$/t		**73.19**
External Dilution		$25/t at	12%
Inside Mining Shape	C$/t		**79.0**
Internal dilution	Included in Mining Shapes		
Block Model In Situ CoV (Target)	C$/t		**85**

15.7.3 Stope Design

The methodology of the stope design is the same as transverse and longitudinal retreat longhole stope design as discussed in Section 15.4.3

15.7.4 Dilution Assessment and Mining Recovery Parameters

Underground mining external dilution and recovery are 12% at $25/t NSR and 95% respectively, the same as discussed in Section 15.6.4 and Table 57 for longhole stope mining. Internal dilution is included in mining shapes.

15.7.5 Stratmat Project Potential RoM Material for Mine Plan

Table 61 and Table 62 show how the in situ mineralized material contained inside planned underground mining shapes converted to potential mining resources (RoM). NSR values are calculated using the assumptions and parameters shown in Table 55.

It should be noted that the Stratmat potential mining resources for mine plan will be directly trucked to Stratmat DMS plant.

Table 63 shows the mineral resources that were not included in the current mine plan.

Table 61: Estimation of Mining Resource for Stratmat Mine Plan by Zone

Zone	Potential Mining Resources for Mine Plan						
	Tonnes (kt)	Zn (%)	Pb (%)	Cu (%)	Ag (g/t)	Au (g/t)	NSR ($/t)
Main Zone (100)	531	4.55	1.65	0.51	48.08	0.53	117
New Zone (200)							
S0 Zone (300)	247	4.70	1.91	0.54	29.52	0.26	119
S5 Zone (400)	135	4.36	1.79	1.39	30.79	0.40	150
S1 Zone (500,501)	2,723	5.00	1.98	0.34	44.76	0.58	122
UG Subtotal	**3,635**	**4.89**	**1.92**	**0.41**	**43.69**	**0.54**	**122**

* Figures have been rounded.

** The estimated RoM is partly based on Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the preliminary economic assessment based on these mineral resources will be realized.

*** The reader is cautioned that the mineralized material should not be misconstrued as a mineral resource or a mineral reserve. The quantities and grade estimates are derived from the block model and include mining dilution and losses.

Table 62: Estimation of Mining Resource for Stratmat Mine Plan by Category

Category	Tonnes (kt)	Zn (%)	Pb (%)	Cu (%)	Ag (g/t)	Au (g/t)	NSR ($/t)
UG Indicated	2,978	4.88	1.88	0.36	45.44	0.58	119
OP Indicated							
Total of Indicated	**2,978**	**4.88**	**1.88**	**0.36**	**45.44**	**0.58**	**119**
UG Inferred	657	4.92	2.07	0.65	35.76	0.38	133
OP Inferred							
Total of Inferred	**657**	**4.92**	**2.107**	**0.65**	**35.76**	**0.38**	**133**

* Figures have been rounded.

** The estimated RoM is partly based on Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the preliminary economic assessment based on these mineral resources will be realized.

*** The reader is cautioned that the mineralized material should not be misconstrued as a mineral resource or a mineral reserve. The quantities and grade estimates are derived from the block model and include mining dilution and losses.

Table 63: Mineral Resources Not Included in the Mine Plan in Stratmat

Category	In Situ Mineral Resources Not Included in Mine Plan						
	Tonnes (kt)	Zn (%)	Pb (%)	Cu (%)	Ag (g/t)	Au (g/t)	NSR ($/t)
UG Inferred	251	0.49	0.12	3.21	15.58	0.54	118
Subtotal of Inferred	**251**	**0.49**	**0.12**	**3.21**	**15.58**	**0.54**	**118**

* There are potential rounding errors in subtotal and total numbers.

** Values calculated using an NSR CoV of $85/t.

*** The mineral resources listed above include Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves.

15.8 Halfmile Project Underground Mine Model

15.8.1 Halfmile Project Underground Mine Layout

Access to the underground mine is planned via the existing portal (5530L) and ramp system that was extended down to the 5360L in 2012. The 2012 trial mining also excavated a fresh air raise (FAR) with secondary egress ladders that can support the initial development and production.

All of the existing ramp and levels will be rehabilitated prior to re-starting development as required. The existing ramp has a minimum cross section of 5.0 m wide by 5.0 m high to accommodate 45-tonne capacity haul trucks and meet ventilation requirements. Underground haulage trucks will be side loaded on the ramp and transport economic materials through the underground ramp system to a surface stockpile pads, where a loader will rehandle the material into highway haul trucks for transport to the Stratmat site some 22 km away via an existing gravel all weather road.
The material will be preconditioned in the dense media seperation (DMS) plant followed by concentrator located at the Stratmat site for the base case or with the preconditioned plant feed being trucked via highway haul trucks to the mill located at the Caribou Mine site for the alternative case.

The waste material sorted out from DMS will be used as backfill material.

All new ramp development is designed at an maximum gradient of -15% with dimensions of 5 m wide x 5 m high, to accommodate the 45-tonne haul trucks.

The initial stope production will be from the Upper zone in the PPCF stopes developed in 2012 on 5480L, 5450L and 5420L. Mining of the Upper zone using PPCF and MCF mining methods will continue for roughly three years before the longhole stopes of the Lower zone start to produce. It will take a further four years of steady ramp development to bring the first of the Deep zone longhole stopes online.

Figure 55 shows an isometric view of the Upper zone post pillar and mechanized cut and fill stopes and the existing workings from the 2012 trial mining program. Figure 56 shows a plan view of the 5120L which is representative of the Lower zone levels. Figure 57 shows the 4380L plan view which is representative of the Deep zone levels.

Figure 58 shows an isometric view of the 3-D mine model looking southwest from HW side of the deposit.

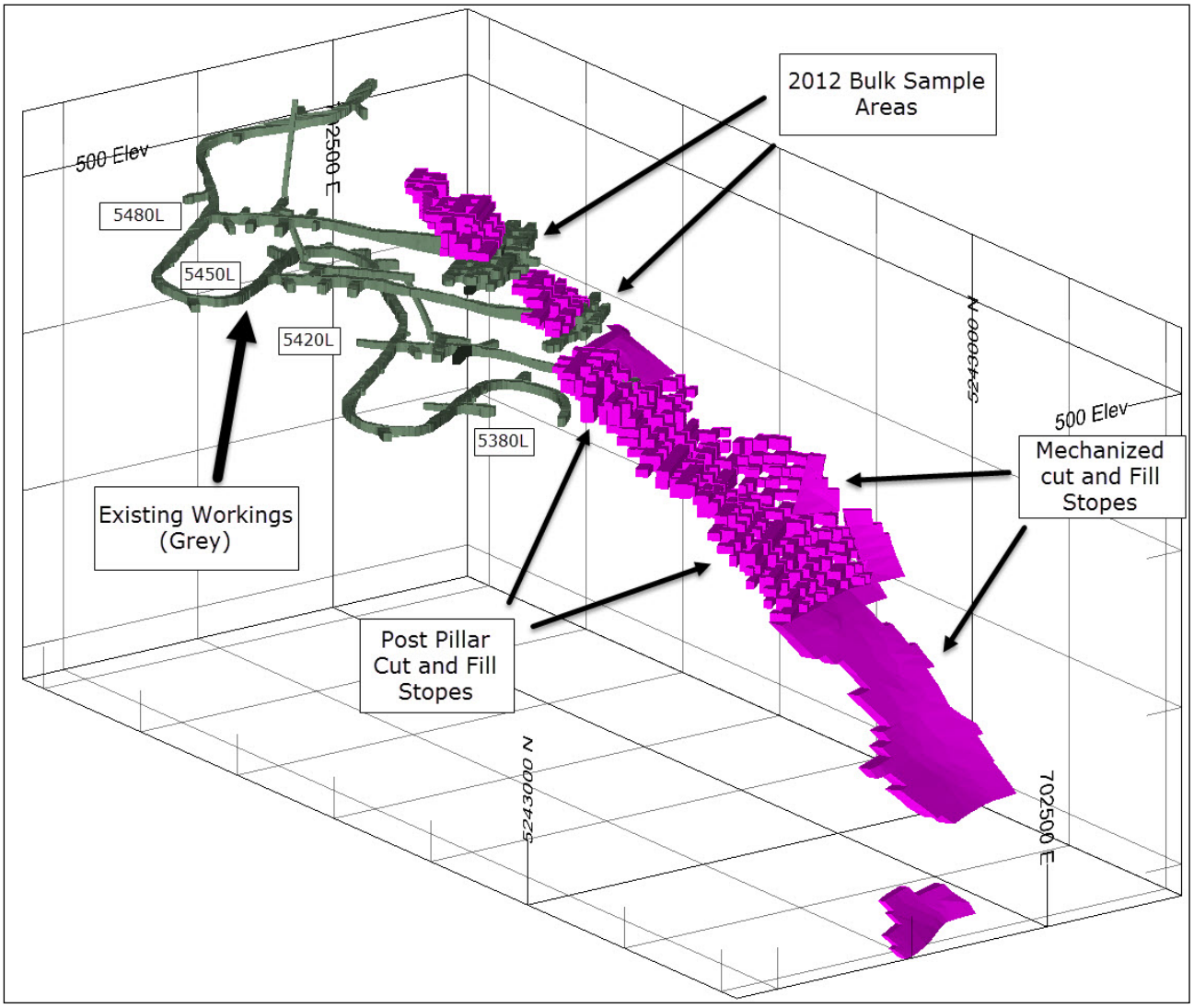


Figure 55: Halfmile 3-D Isometric View of Upper zone Post Pillar and Mechanized Cut and Fill Stopes (Looking South West)

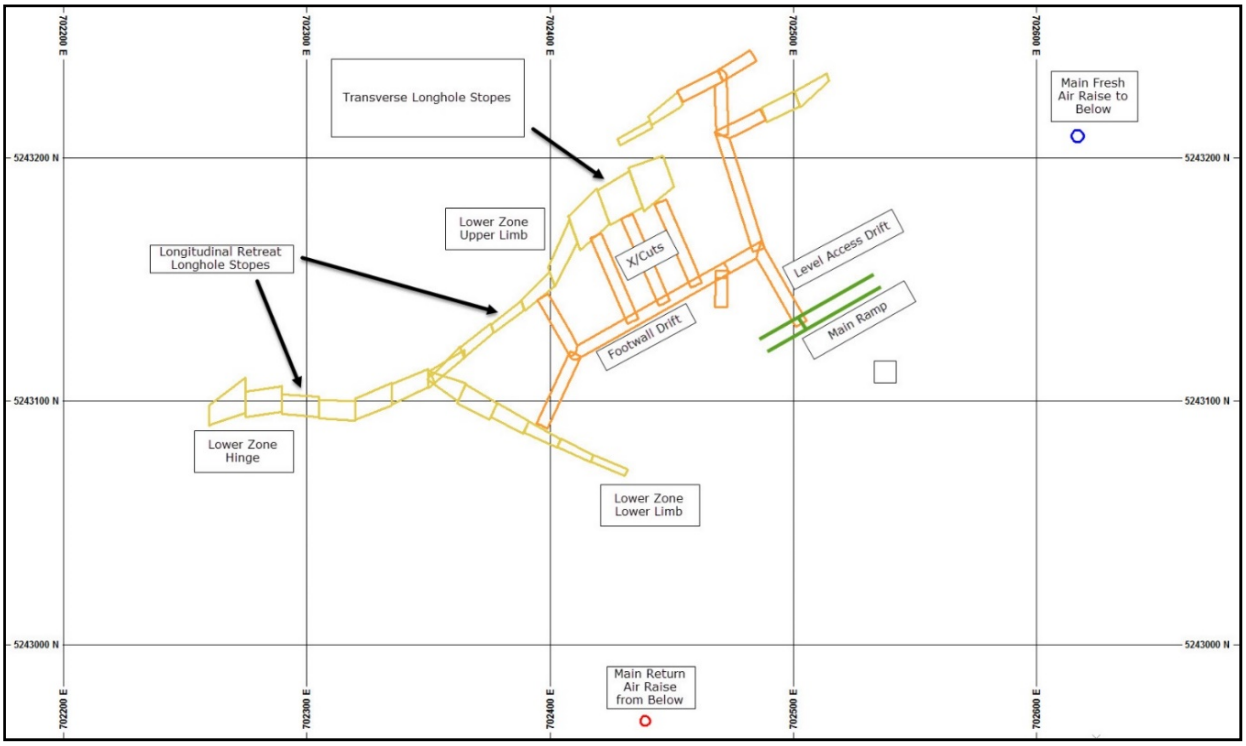


Figure 56: Halfmile Plan View of Lower Zone Longhole Stopes on 5120L

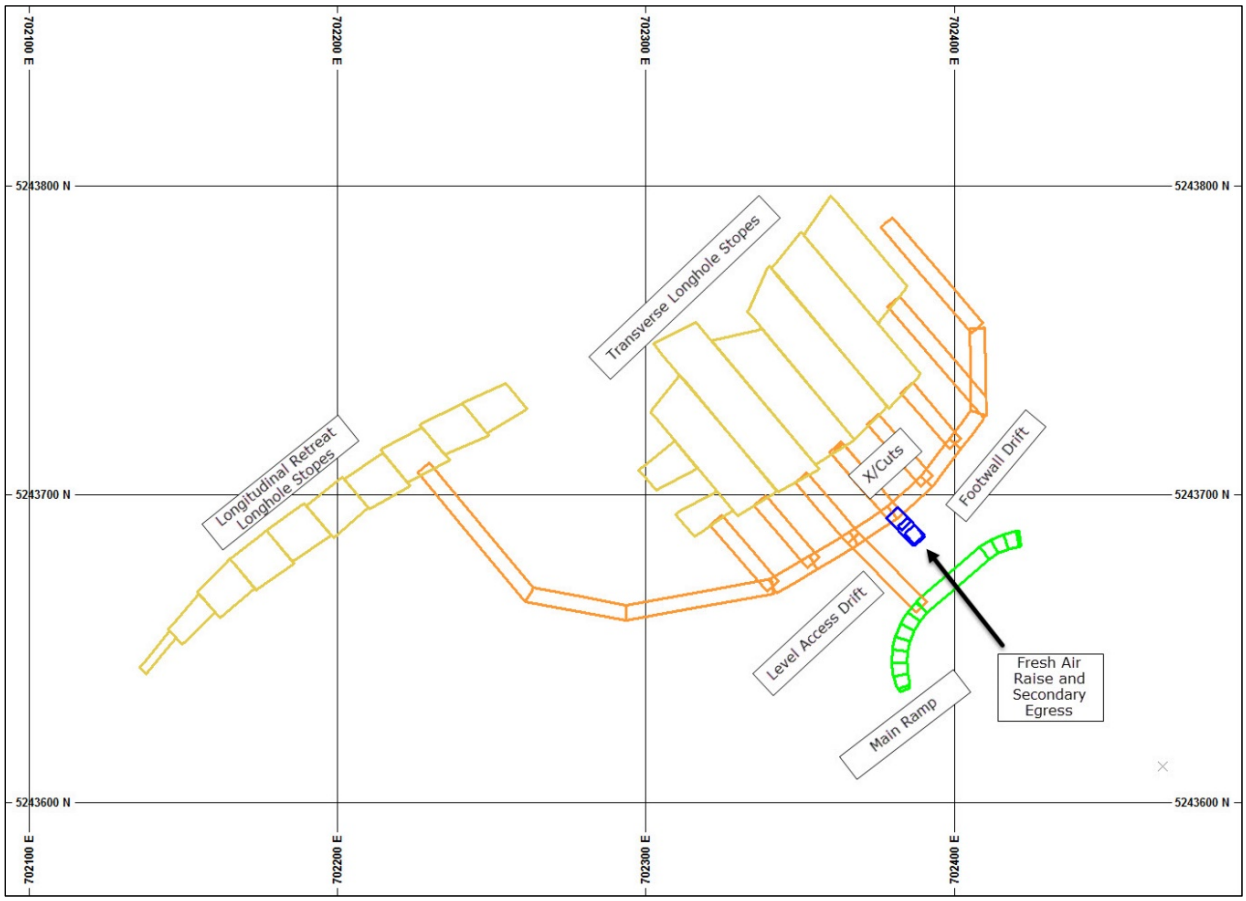


Figure 57: Halfmile Plan View of Deep Zone Longhole Stopes on 4380L

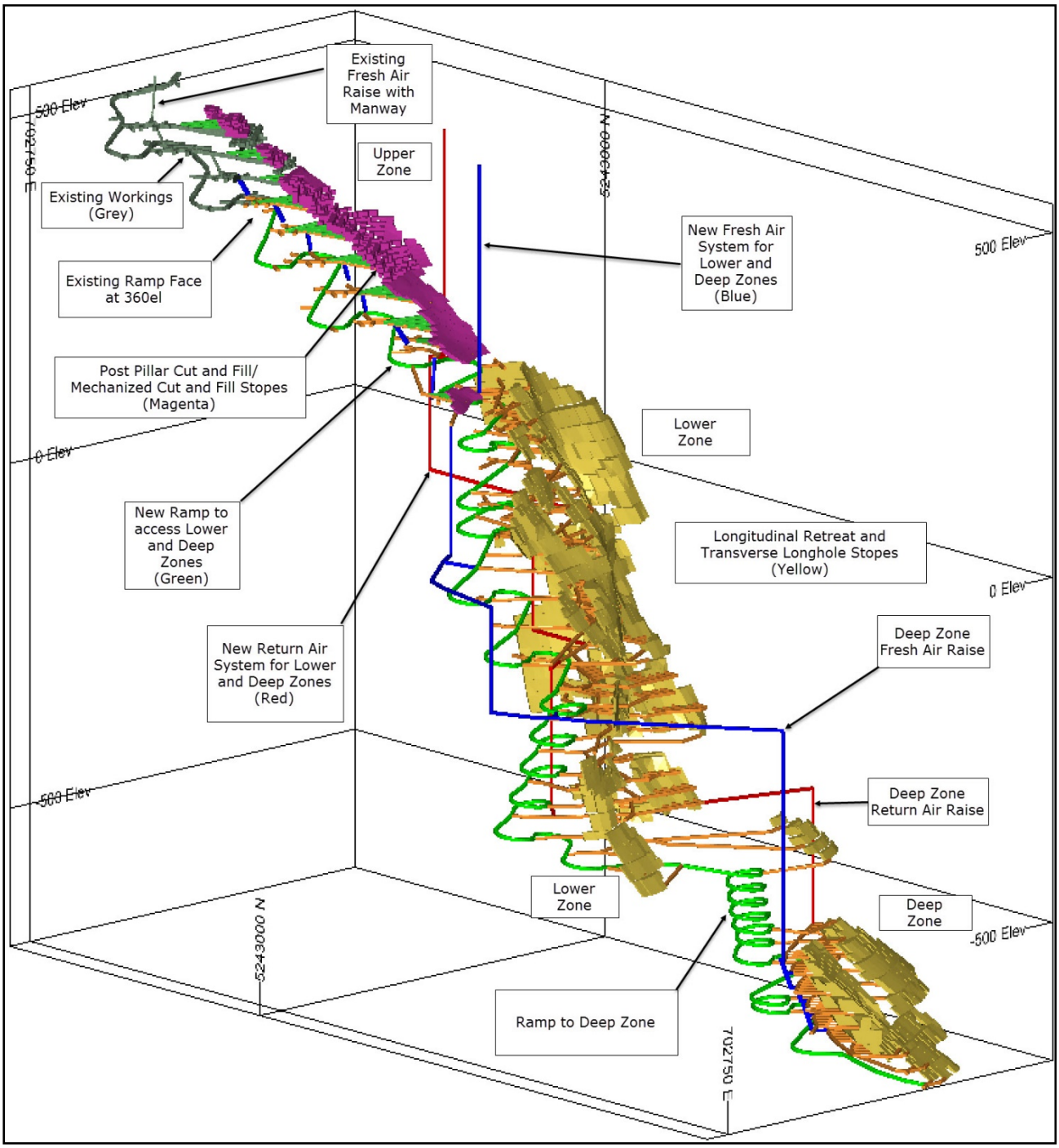


Figure 58: Halfmile 3-D Mine Model Isometric View (Looking Southwest)

The existing FAR was developed as a 3 m by 3 m Alimak raise and is capable of providing 118 m^3/s (250,000 cfm) airflow which is enough to support mining of the Upper zone on 2−3 levels and ramp development. A new 5-m diameter main ventilation raise will be developed from the surface to support mining and development of the Lower and Deep zones. A new 4.5-m diameter main return air raise will also be required to support development and production of the Lower and Deep zones.

Each of these raises systems will be advanced in 4−5 sections with transfer drifts in order to follow the dip of the mineralization body as the ramp face advances.

A series of smaller FARs and manways (not shown in Figure 58) will be developed from level to level by Alimak raising or drop raising method to connect the main FAR to the active levels in a manner similar to the Upper zone.

The return air from the active levels will report to the ramp where it will travel up to the next return air raise (RAR) location where excess return air will be diverted into the raise.

15.8.2 Halfmile Project Lateral Development

Table 64 is a summary of LoM lateral development requirements. All the capital waste development quantities shown include an average 15% mark-up in addition to the modelled amounts. This was done to account for development not modelled in 3-D mine design such as safety bays, level sumps, electrical cut outs, gear storage areas, explosive magazines, etc.

With lateral waste development totalling 33,000 m, the project achieves a development ratio of 285 t/m. Waste development tonnages (including vertical development, slashing) is estimated at 2,472 kt yielding a waste/mining resource ratio of 0.264.

Table 64: Summary of Halfmile LoM Lateral Development Requirements

Heading	Type	Length (m)	Size (m x m)
Capitalized			
Ramp Development	Waste	8,830	5.0 x 5.0
Lateral Waste Development	Waste	15,900	4.5 x 5.5
Subtotal Capitalized		**24,730**	
Expensed			
Lateral Waste Development	Waste	8,220	4.5 x 4.5
On Lens Development	On Vein	7,060	Varied
Subtotal Expensed		**15,280**	
Total Lateral Development		**40,010**	

Note: waste development metres include 15% markup

15.8.3 Halfmile Project Raise Requirement

Table 65 is a summary of LoM raising requirements. These are all ventilation raises, as the project does not require any rock passes. Slot raising for the longhole stopes is excluded from the table.

Table 65: Summary of Halfmile LoM Raise Development Requirements

Heading	Type	Length (m)	Size (m x m)	Manway
Main Fresh Air Raises (4 sections)	Waste	1,020	5m Dia.	N
Internal Fresh Air Raises	Waste	1,370	3.0 x 6.0	Some
Internal Secondary Egress Raises	Waste	1,290	2.0 x 2.4	Y
Main Return Air Raise (5 sections)	Waste	1,020	4m Dia.	N
Total Line Metres	Waste	**4,700**		

15.9 Stratmat Project Mine Model

15.9.1 Stratmat Project Underground Mine Layout

Access to the underground mine is planned via two ramp systems (Figure 59, Figure 60).

The main ramp portal will be located on the footwall side of the S1 Shallow zone. The main ramp will be extended from the surface down to approximately 700 m below surface (-340 mEL) to access S1 Shallow zone, S1 Deep zone, S0 zone, and S5 zone mineralization and stopes, where S5 zone mineralization will be accessed through two horizontal drifts (80 mEL and 0 mEL) bypassed from the main ramp and a secondary connection ramp. The 5 x 5 m main ramp and a 4.5 x 4.5 m FAR will supply fresh air to the required mining faces, and 5 m x 5 m RAR will be the exhaust air route. Both raises will be developed section by section with the mine development moving downwards.

The Main zone (Zone 100) ramp portal will be located on the footwall side of the Main zone. This ramp is dedicated to access the Main zone underground mineralization. The Main zone ramp will be the fresh air route and a 2.5x 2.5 m RAR will be the exhaust air route.

Since the Main zone and the S1 Shallow/Deep zone are approximately 750 m apart, a high level trade-off study shows that using a standalone ramp system to access the Main zone mineralization has economic benefit over using connection drifts from the main ramp system to the Main zone mineralization.

The New zone is a high copper and low zinc grades of mineralization zone. Due to less tonnage, a high level trade-off study shows that it has no economic benefit to be included in the current PEA mine plan. Therefore, the New zone is excluded from the PEA mine plan.

The main ramp and the Main zone ramp are designed at average gradients of -15%, while the secondary ramp is designed at an average gradient of -20% because there is no loaded truck planned travelling up dip. The main ramp dimensions are sized to accommodate the 45-tonne capacity of haul trucks, and the Main zone ramp and the secondary ramp are sized to accommodate the 30-tonnes trucks which will be also used for development.

Underground haulage trucks will transport economic materials through the configured underground ramp systems directly to the Stratmat mill plant. The development waste material will be used as backfill material to backfill mined stope voids, supplemented by back trucked DMS reject waste from the DMS waste pile.

The initial stope production will be from the upper levels of the S1 Shallow zone, and progress down dip to S1 Deep zone. Until -20 mEL mining block (approximately 380 m below surface) starts production, there is not much RoM that can be mined. It will take approximately two years to open up this mining fronts to maintain a steady underground mining production.

The Main zone underground development will be started in the second half of the mine life. The Main zone underground production is planned to serve as supplementary production to the main ramp system production and to provide flexibility for the Stratmat underground production.

Figure 59 shows the 3-D mine model in plan view. Figure 60 shows an isometric view of the 3-D mine model looking northeast from the HW side of the deposit, including major underground development and underground target mineralization (stopes). It can be seen from the figures that the major mining resources are in S1 (Shallow and Deep) zone.

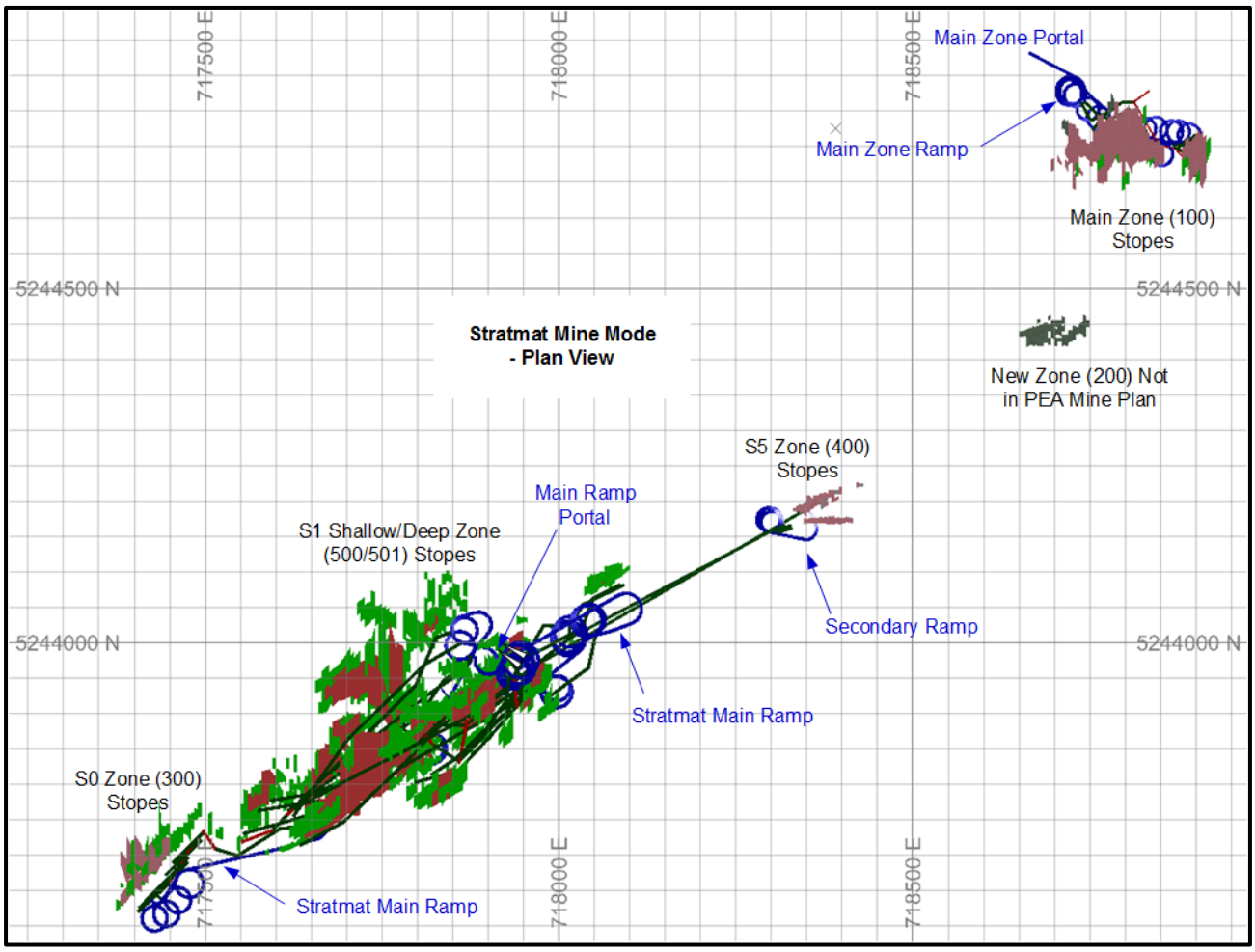


Figure 59: Plan View - Stratmat 3-D Mine Model (50 m grid)

Mining resources (RoM) development to support longhole stoping, not shown in the figures, is planned on 20 m spaced levels. Each ramp spiral or straight segment covers 20−40 m vertical, dependent on the spatial relationship between stopes on different levels.

The fresh air will be supplied through the main ramp and a 3.6-m diameter raised bored FAR (from surface to -200 mEL), equally split fresh airflow between them, and capable of providing 189 m^3/s (400,000 cfm) airflow which is enough to support mining of the S1 (Shallow/Deep), S0, and S5 Zones on 2-3 levels/mining fronts and ramp development. The main exhaust ventilation raise (RAR) extends from surface to the bottom of the mine, which comprises raised bored sections 4.5 and 3.0 m in diameter, and some drop raised sections of 5 x 5 m^2 where levels can be accessed. The FAR and the bottom segments of the RAR from -200 mEL to -340 mEL will be equipped with manways to provide second exit from mine bottom to -surface.

For the Main zone, an independent ventilation system will be adopted. Fresh air of 42 m^3/s (90,000 cfm) will be drawn through the Main zone ramp and distributed to mining faces, and the return air will be through a 2.4 m diameter raised bored raise, where a manway will be equipped to provide second exit for the Main zone production.

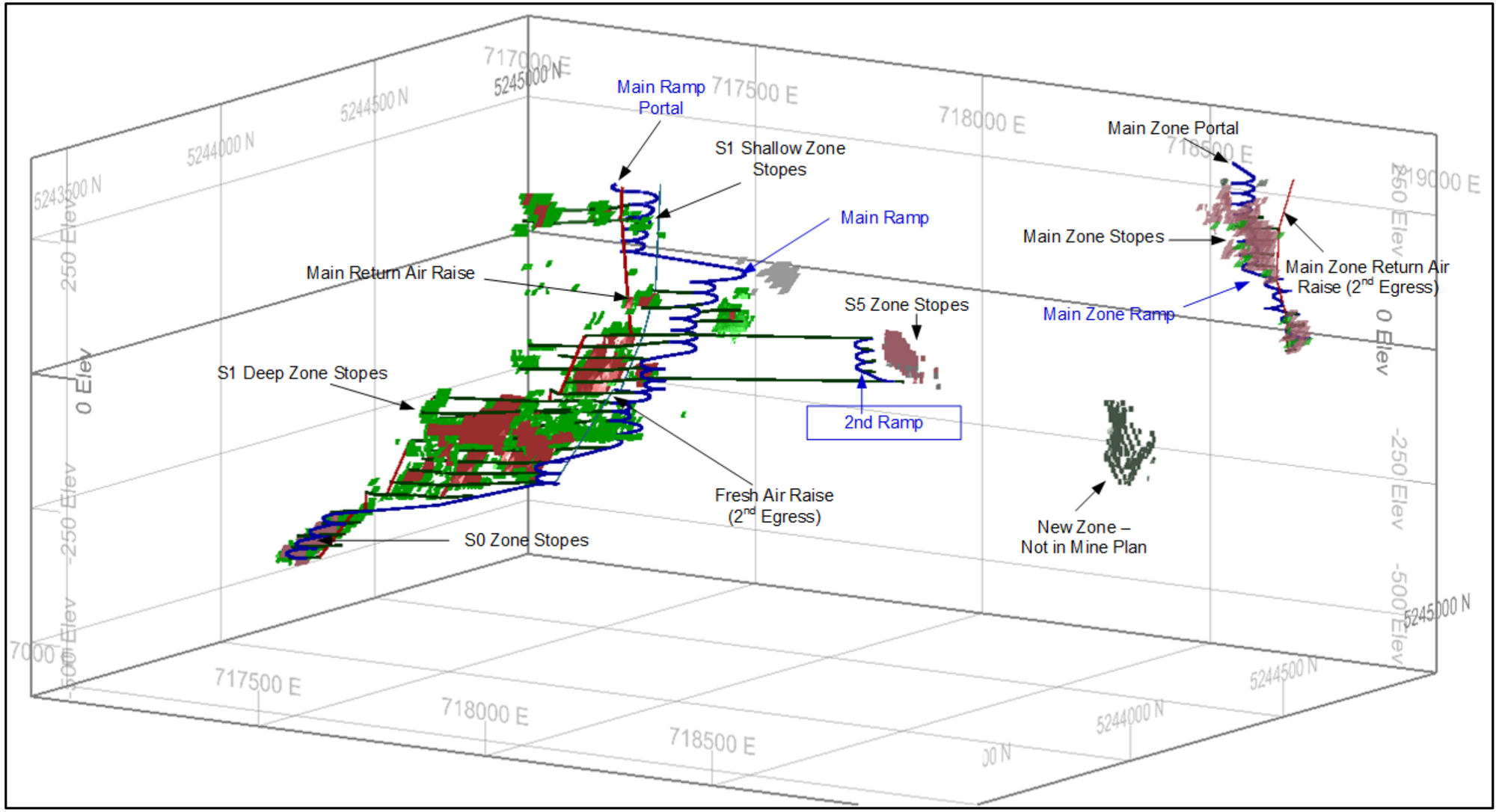


Figure 60: Stratmat 3-D Mine Model Isometric View (Looking Northeast)

The mine layout does not include dedicated diamond drill drifts, but it is believed the drilling station can be set up on appropriate ramp sections. Definition drilling costs have been included in the mine plan.

15.9.2 Stratmat Project Lateral Development

Table 66 is a summary of LoM lateral development requirements modelled. All the waste development quantities shown include an average 15% mark-up in addition to the modelled amounts. This was done to account for development not modelled in 3-D mine design such as safety bays, level sumps, electrical cut outs, gear storage areas, explosive magazines, etc.

With lateral waste development totalling 19,600 m, the project achieves a development ratio of 180 t/m. Waste development tonnages (including vertical development, slashing) is estimated at 1,531 kt yielding a waste/mining resources ratio of 0.435.

Table 66: Summary of Stratmat LoM Lateral Development Requirements

Heading	Type	Length (m)	Size (m x m)
Capitalized			
Ramp Development	Waste	5,352	5.0 x 5.0
Ramp Development	Waste	2,477	4.5 x 4.5
Lateral Waste Development	Waste	6,556	5.0 x 5.0
Lateral Waste Development	Waste	1,838	4.5 x 4.5
Lateral Waste Development	Waste	201	3.0 x 3.0
Subtotal Capitalized		**16,424**	
Expensed			
Lateral Waste Development	Waste	3,904	4.5 x 4.5
On Lens Development	On Vein	4,387	Varied
Subtotal Expensed		**8,569**	
Total Lateral Development		**24,994**	

Note: waste development metres include 15% markup

15.9.3 Stratmat Project Raise Requirement

Table 67 is a summary of LoM raising requirements. These are all ventilation raises, as the project does not require any rock passes. Slot raising for the longhole stopes is excluded from the table.

Table 67: Summary of Stratmat LoM Raise Development Requirements

Heading	Type	Length (m)	Size (m x m)	Manway
Fresh Air Raises	Waste	608	3.6m Dia.	Y
Main Return Air Raises	Waste	626	4.5m Dia.	N
Main Return Air Raises	Waste	155	3.0m Dia.	Y
Main Zone Return Air Raise	Waste	342	2.4m Dia.	Y
Total Line Metres		**1,731**		

15.10 Halfmile Project Underground Mine Production Schedule

The production rate analysis was derived from first principles, using the rated capacity of equipment and available mining fronts. Historical trial mining production achievements were considered during this analysis. SRK notes that rules-of-thumb predict a mining rate that varies from 2,100 t/d to 2,900 t/d.

As discussed in Section 15.4, the Halfmile underground mine is in care and maintenance and mine production is expected to be restarted in January 2020 at a production rate of approximately 900 t/d starting in the existing PPCF blocks with limited rehabilitation work. The production rate from the PPCF stopes has been reduced to account for the interference expected due to the high ramp development rates including the blast at will requirements and the limited ventilation available.

As the contractor develops the down ramp during the first three years, each level will be collared and only the critical infrastructure developed to support ramp development. A company development crew will continue level development as required to maintain the scheduled production rate at a later date. The Contractor is scheduled to demobilize from site once the ramp has been developed to the 4860L and the 4880L has been developed to the mineralization in Q2 2023. It is expected that as the PPCF & MCF stopes are mined out, the crews will transition into development crews.

Starting in 2024, ramp development will progress at a lower advance rate as required to support future production by opening up new mining blocks in the Lower and Deep zones. Mine sequencing is top down for mining blocks and bottom up within each mining block. The mining blocks for the Upper zone are nominally 30 m high for cut and fill mining methods. The mining blocks for the Lower and Deep zones are designed for SLOS and SLR mining methods and are 100 m high with 20 m sub-levels.

The planned production rate of 2,600 t/d or 910 kt/a will be achieved in the Q1 of 2024. The underground mine production period extends from January 1, 2020 to the end of 2032 for a period of 13 years.

Planned LoM RoM production is 9,376 kt at $124/t NSR, with metal grades of 5.86% zinc, 1.91% lead, 0.12% copper, 28.34 g/t silver, and 0.19 g/t gold.

Underground development advance rates for owner development crews were scheduled at not more than 420 m/month or 140 m/month/jumbo with multiple headings planned most of the time. The contractor ramp development rate is higher at up to 192 m/mo including collaring levels and critical infrastructure. The contractor is assumed to be properly resources to achieve this rate and that the contractor may blast at will, which will impact all other activities underground.

Table 68 shows the LoM RoM production plan. Table 69 shows the LoM waste rock handlings and backfill material balance.

Table 68: Halfmile Life of Mine Run-of-Mine Production Plan

Name	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Total
Days	D	350	350	350	350	350	350	350	350	350	350	350	350	350	
Daily Production	**t/d**	**903**	**908**	**1,133**	**1,694**	**2,601**	**2,600**	**2,601**	**2,600**	**2,803**	**2,802**	**2,592**	**2,258**	**1,292**	
PPCF & CF	d/t	**903**	**908**	**722**	**60**	0									
LH	d/t	0	0	**411**	**1,634**	**2,601**	**2,600**	**2,601**	**2,600**	**2,803**	**2,802**	**2,592**	**2,258**	**1,292**	
Mining Production	**Kt**	**316**	**318**	**397**	**593**	**910**	**910**	**910**	**910**	**981**	**981**	**907**	**790**	**452**	**9,376**
NSR	**$/t**	**130**	**126**	**135**	**146**	**144**	**142**	**132**	**126**	**119**	**115**	**108**	**98**	**95**	**124**
Zn	%	5.57	5.45	5.85	6.40	6.47	6.62	6.17	5.88	5.74	5.62	5.44	5.17	5.15	**5.86**
Pb	%	1.88	1.86	2.25	2.45	2.34	2.23	2.17	2.12	1.81	1.64	1.53	1.29	1.17	**1.91**
Cu	%	0.37	0.29	0.18	0.08	0.07	0.07	0.07	0.07	0.11	0.15	0.11	0.13	0.14	**0.12**
Ag	g/t	38.06	39.14	40.31	42.86	36.83	30.33	28.55	27.84	25.43	22.35	21.85	17.45	15.14	**28.34**
Au	g/t	0.58	0.46	0.31	0.27	0.22	0.23	0.21	0.18	0.15	0.11	0.10	0.06	0.03	**0.19**

* Numbers are rounded.

Table 69: LoM Waste Rock Handlings and Backfill Material Balance

Name	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Total
Waste Rock Handling															
Broken Underground	kt	**235**	**261**	**316**	**319**	**325**	**273**	**201**	**181**	**189**	**105**	**24**	**24**	**18**	**2,472**
Backfill Required	kt	174	175	218	326	501	501	501	501	540	540	500	435	249	5,162
Waste to HM Stockpile	kt	61	86	98											196
Waste from HM Stockpile	kt				7	176	62								196
Waste/ DMS rejects from Stratmat	kt						166	300	320	351	435	476	411	231	2,691
Total Backfill Placed	**kt**	174	175	218	326	501	501	501	501	540	540	500	435	249	5,162

* Replacement ratio of 55% and numbers are rounded

15.11 Stratmat Proejct Mine Production Schedule

The production rate analysis was derived from first principles, using the rated capacity of equipment and available mining fronts. Halfmile historical trial mining and Caribou production achievements were considered during this analysis. SRK notes that rules-of-thumb predict a mining rate that varies from 1,000 t/d to 1,700 t/d.

The strategy to develop the Stratmat Mine is to develop the main ramp downwards using a mining contractor to open up the first underground mining front as soon as possible in the second year. This development strategy is cooperation with the timeline of the Stratmat DMS plant construction and commissioning and also considering the combined RoM production from Halfmile and Stratmat.

In the Q2 of the second year, the underground mine stope production can be initiated. In the end of the second year, all the underground infrastructure to support targeted 1,400 t/d mine production will be in place and mine production rate will be reached to above 60% of target production rate. Therefore, the Stratmat project preproduction period can be defined as a 24-month or 2-year period from January 1, 2020 to December 31, 2021, which is dependent on Trevali securing the necessary financing and approvals to develop the project. The Stratmat production period will extends from January 1, 2022 to the Q4 2029 for a period of eight years.

The Main zone underground development will be started in the second half of the mine life. The Main zone underground production is a supplement to the S1, S0, and S5 Zone production, which will provide flexibility of the underground production.

Planned LoM RoM or mill feed production is 3,635 kt at $122/t NSR, with metal grades of 4.89% zinc, 1.92% lead, 0.41% copper, 43.69 g/t silver, and 0.54 g/t gold.

Underground development advance rates were scheduled at not more than 192 m/month/jumbo and 120 m/month/jumbo for contractor and owner mining, respectively, with multiple headings planned most of the time.

Table 70 shows the Stratmat LoM RoM production plan. Table 71 shows the LoM waste rock handlings and backfill material balance. It should be noted that at the end of the combined project life, there is no waste rock left on the surface wastepile.

15.12 Combined Project Run-of-Mine and Mill Feed Production Plans

Table 72 shows the combined life of project RoM production plan, which is a combination of Halfmile LoM RoM production (Table 68) and Stratmat LoM RoM production (Table 70).

Table 73 shows the combined life of project mill feed production plan. It should be noted that:

- Year 2020 mill plant feed is sourced from Halfmile RoM materialization.
- From year 2021, mill plant feed is sourced from Stratmat DMS economic product. The DMS product tonnes and grades are estimated using 22% reject rate, 1.5% overall metal loss for Halfmile RoM and 3.0% overall metal loss for Stratmat RoM, as discussed in Section 12.6.1.

Table 70: Stratmat Life of Mine Run-of-Mine Production Plan

Name	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Days	d	350	350	350	350	350	350	350	350	350	350	350	350	350	350	335	
Daily Production	t/d	10	383	1,262	1,400	1,404	1,400	1,400	1,400	1,199	528						
Total Production	**kt**	**4**	**134**	**442**	**490**	**491**	**490**	**490**	**490**	**420**	**185**						**3,635**
NSR (not count Au)	**$/t**	**243**	**141**	**120**	**114**	**121**	**126**	**122**	**124**	**129**	**100**						**$122**
Zn	%	9.17	5.46	4.55	4.60	5.09	5.39	5.18	4.51	5.23	3.54						**4.89**
Pb	%	4.70	2.41	1.82	1.80	1.99	2.08	2.06	1.80	1.93	1.36						**1.92**
Cu	%	0.38	0.44	0.55	0.38	0.28	0.24	0.24	0.72	0.39	0.73						**0.41**
Ag	g/t	33.06	42.97	46.34	47.03	43.37	43.87	44.62	35.16	47.38	41.38						**43.69**
Au	g/t	0.22	0.42	0.58	0.55	0.61	0.61	0.59	0.41	0.45	0.58						**0.54**

* Numbers are rounded.

Table 71: LoM Waste Rock Broken and Backfill Material Balances

Name	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Waste Rock Handling																	
UG Waste Broken	kt	204	334	251	138	103	102	247	117	75	10						1,581
Waste Backfill Requirement	kt	0	61	237	263	263	263	263	263	225	110						1,946
Waste to Stope Voids	kt	0	61	237	138	103	102	247	117	75	10						1,090
Waste to/(from) Wastepile	**kt**	204	273	14	-125	-161	-160	-16	-30								
Total Waste on Waste Pile	**kt**								115	149	100						**365**

* Numbers are rounded

Table 72: Combined Life of Project RoM Production Plan

Name	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Days	d	350	350	350	350	350	350	350	350	350	350	350	350	350			
Daily RoM Prod'n	**t/d**	914	1,291	2,395	3,094	4,005	4,000	4,001	4,000	4,001	3,330	2,585	2,246	1,281			
Total RoM Prod'n	**kt**	320	452	838	1,083	1,402	1,400	1,400	1,400	1,400	1,165	907	790	452			**13,011**
Halfmile	**kt**	316	318	397	593	910	910	910	910	981	981	907	790	452			9,376
Stratmat	**kt**	4	134	442	490	491	490	490	490	420	185						3,635
NSR (not count Au)	**$/t**	**131**	**131**	**128**	**132**	**136**	**136**	**128**	**125**	**122**	**113**	**108**	**98**	**95**			**124**
Zn	%	5.61	5.46	5.16	5.58	5.99	6.19	5.82	5.40	5.59	5.29	5.44	5.17	5.15			5.59
Pb	%	1.91	2.02	2.02	2.15	2.21	2.18	2.13	2.01	1.85	1.59	1.53	1.29	1.17			1.91
Cu	%	0.37	0.34	0.37	0.21	0.14	0.13	0.13	0.30	0.19	0.24	0.11	0.13	0.14			0.20
Ag	g/t	38.00	40.28	43.48	44.74	39.12	35.07	34.18	30.40	32.01	25.37	21.85	17.45	15.14			32.63
Au	g/t	0.58	0.45	0.45	0.40	0.35	0.36	0.34	0.26	0.24	0.19	0.10	0.06	0.03			0.29
Notes:		<To Caribou Mill>	<To Stratmat DMS Plant>														

* Numbers are rounded.

Table 73: Combined Life of Project Mill Plant Feed

Name	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Days	d	350	350	350	350	350	350	350	350	350	350	350	350	350			
Daily Mill Feed	**t/d**	**914**	**1,007**	**1,868**	**2,413**	**3,124**	**3,120**	**3,121**	**3,120**	**3,121**	**2,597**	**2,022**	**1,762**	**1,008**			
Total Mill Feed	**kt**	**320**	**352**	**654**	**845**	**1093**	**1092**	**1092**	**1092**	**1092**	**909**	**708**	**617**	**353**			**10,219**
Halfmile	**kt**	316	248	309	463	710	710	710	710	765	765	708	617	353			9,376
Stratmat	**kt**	4	105	344	382	383	382	382	382	327	144						3,635
NSR (not count Au)	**$/t**	$131	$164	$160	$165	$171	$171	$161	$157	$154	$142	$136	$124	$120			**154**
Zn	%	5.61	6.86	6.48	7.01	7.52	7.78	7.32	6.79	7.03	6.67	6.87	6.53	6.50			6.99
Pb	%	1.91	2.54	2.54	2.70	2.78	2.74	2.68	2.52	2.32	2.01	1.94	1.63	1.48			2.39
Cu	%	0.37	0.42	0.46	0.27	0.18	0.16	0.16	0.37	0.24	0.30	0.14	0.16%	0.18			0.25
Ag	g/t	38.00	50.62	54.44	56.09	49.11	43.99	42.86	38.16	40.15	31.91	27.59	22.04	19.12			40.70
Au	g/t	0.58	0.56	0.56	0.50	0.44	0.45	0.43	0.33	0.30	0.23	0.13	0.07	0.04			0.36
Notes:		<RoM Mill Feed>	<Mill Feed from Stratmat DMS Product >														

* Numbers are rounded.

15.13 Halfmile Project Equipment, Services and Infrastructure

15.13.1 Halfmile Project Contractor Involvement

As the intent is to establish an owner-operated mine, contractor involvement will be kept to a minimum with the exception of the initial ramp development contract which is expected to last 3 years.

There are several services where it is generally advantageous to contract out, typicaly where specialty skills or equipment is required such as the surface haulage contract. It may also be advantageous to contract out the supply of cement to the site underground cement storage due to the environmental restrictions on storing cement on the surface at the Halfmile project.

15.13.2 Halfmile Project Mine Equipment

Table 74 shows the planned mining fleet, including the surface units required to support the mine plan. The maximum number of units is shown for each equipment type, and these numbers vary throughout the mine life, especially trucks.

The following section describes the application of the equipment in the mining plan.

Equipment for development crews will consist of:

- 2-boom face jumbo
- 14-tonne capacity LHDs
- Mechanized bolter and mobile shotcrete unit for ground support
- Bulk ANFO or emulsion loader
- Scissor lift for ground support, face loading explosives, and services work
- Small buggy drill for cable bolting (Contractor).

Equipment for cut and fill crews will consist of the same equipment as for the development crews, with the addition of the following secondary fleet for more selective mining in certain areas of the Upper zone:

- 1-boom jumbo with sidewinder capability (leased)
- 6-tonne capacity LHD

The intent is that the cut and fill crews will be absorbed by the development crews as the cut and fill mining tapers off and efforts to bring the Lower zone into production ramp up.

The haulage crew will be equipped with:

- 14-tonne capacity LHDs
- 45-tonne UG Haulage trucks
- 30-tonne UG Haulage trucks with ejector boxes for CRF/RF placement

14-tonne capacity LHDs will be used for loading plant feed materials into 45-tonne trucks for haulage to the surface and for loading waste into 45-tonne or 30-tonne trucks for haulage to the surface or to underground remuck bays for backfill supply.

Table 74: Halfmile Planned Mining Equipment (2028)

Underground Equipment	Peak Units	Comment
14-Tonne UG LHD	6	
45-Tonne UG Truck (Dump-Box)	8	Haulage
30-Tonne UG Truck (Ejector-Box)	2	Rockfill
120M Grader (CAT)	1	
Jumbo 2 Boom	3	
Jumbo 1 Boom	1	Lease
Scissor Lift	2	
Buggie Drill (Stopemate)	1	Cable Bolting
Longhole Drills (Tophammer or ITH)	2	Contractor
Boom Truck	1	
Toyota Man Carriers (Crews)	2	
Minecat c/w Boom	1	Survey
Toyota Truck (Technical)	1	
Toyota Truck (Shifters)	2	
Toyota Truck (Electrical)	1	
Toyota Truck (Mechanical)	1	
Tractor UG Forklifts	2	
BTI Rockbreaker/Blockholer	1	
Mechanized Bolter	3	
Shotcrete Unit with carrier	1	
Emulsion Bulk Loader	1	
Emulsion/ANFO Face Loader	1	
6-Tonne UG LHD	1	
Fuel/Lube Truck	1	
Subtotal Underground	**46**	
Surface Equipment		
Surface Pickup Truck	5	Lease
Surface Forklift/Loader	1	
Mine Rescue Vehicle (MINECAT UT99C)	1	
Surface Loader	2	Contractor
Surface Haul Trucks	6	Contractor
Subtotal Surface	**15**	
Total Underground & Surface	61	

Longhole production crews will be equipped with:

- 14-tonne capacity LHDs
- 6-tonne capacity LHD
- Bulk ANFO or emulsion loader
- Scissor lift for services work
- Various tophammer and/or ITH production drills (Contractor).

Longhole stope production mucking will employ 14-tonne and 6-tonne capacity LHDs depending on stope width. These units will also be used to tram waste rock backfill along strike into empty stopes.

The blockholer unit will be used to drill and blast oversize materials that may block draw points, and will also operate on remote control as needed to drill and blast large oversize materials that may occur inside stopes beyond the brow.

The contractor's production drills will work in longhole stopes drilling down holes or up holes for sill pillar recovery.

The shotcrete spray unit will be a skid mounted unit supplied by bulk bags of dry shotcrete. It will be used for backfill barricade construction and in development headings as needed, depending on ground conditions.

Supplies will be moved underground by the main ramp. Nipping will be done underground using a boom truck and forklift, while on the surface a forklift will be used to prepare materials for transport.

Toyota carriers and trucks will provide transportation for operations and maintenance supervision and for technical staff. The personnel carrier will move employees in and out of the mine at shift change.

The grader will maintain the ramps and will work at times with a scoop cleaning up slimes or spreading road bed aggregate.

Maintenance crews will have available a service truck, a boom truck, a scissor lift (for electrical work), a fuel and lube truck, and a tractor.

On the surface, the contractor's wheel loader will be used to load plant feed into highway rated haulage trucks for the 22-km trip to the Stratmat mill. The same loader may load underground trucks with waste rock for backfill.

An additional fleet of equipment to be provided by the ramp development contractor will be required for the first three years. This fleet is expected to consist of twelve piece of gear including two jumbos, two LHDs, two mechanized bolters, a scissor lift and other support equipment.

15.13.3 Halfmile Project Mine Services and Infrastructure

Site Development Plan and Major Infrastructure

Figure 61 shows the Halfmile Mine site development plan showing the locations of the major surface infrastructure required to support the underground mining.

It should be noted that much of the surface infrastructure is already in place, on care and maintenance, and observed to be in good conditions during SRK's site visits. This includes the security building, water treatment plant and settling ponds, office trailers, two shops, small dry, generator sets with 60,000 litre diesel fuel tank, a diesel fueling station with 30,000 litre tank, miscellaneous small storage facilities and the portal. There is also a large core shack and core racks on site which are used for logging and storage of core from both Halfmile and Stratmat.

The 350 horsepower surface ventilation fan and 20 MBTU mine air heater have been removed and used at the Caribou Mine. These will have to be replaced prior to restating mine development. Current plans also call for an expansion to the water treatment system, building of an office and dry building and the establishment of surface powder and cap magazines. Additional main fans and mine air heaters will also be required prior to starting production from the Lower zone.

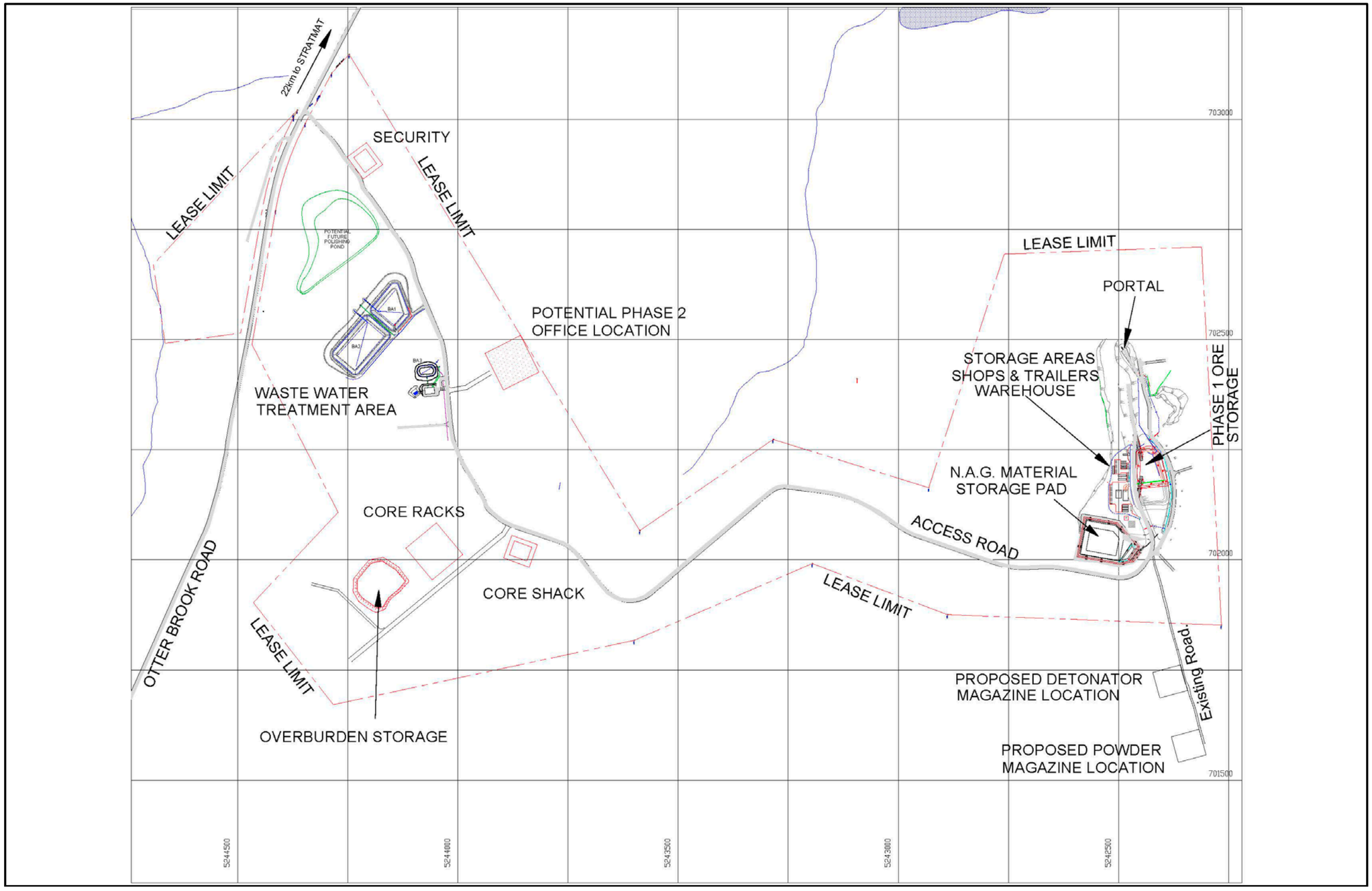


Figure 61: Halfmile Underground Mine Major Surface Infrastructure (Trevali 2011)

Definition Drilling

A definition drilling unit cost of $0.36/t plant feed is included in the PEA. A detailed drilling plan has not been prepared. Considering that approximately 67% of targeted mineralization is in the Measured and Indicated mineral resources categories, which will require less definition drilling, it is SRK's opinion thatthe planned unit cost for definition drilling should be sufficient for the Halfmile Stratmat Project.

Materials Handling

Primary access for workers and equipment will be via an existing portal and decline (main ramp) from the surface. The existing ramp has been developed from the surface to the 5360L elevation (170 m below surface). This ramp will be extended down to the 4880L elevation (650m below surface) over the course of 3.5 years. The ramp will not reach its ultimate depth of 1230 m below surface (4300L) for a further 5 years as the remainder will be developed on a just-in-time basis.

The main ramp is designed at a maximum gradient of -15% with a cross section of 5.0 wide by 5.0 m in height. All RoM and waste handlings will use 14-tonne LHDs loading 45-tonne or 30-tonne ejector box trucks. Trucks will be loaded at the level access intersection from remuck bays planned near the main ramp and travel up the ramp system to the DMS plant. Remucks will generally be less than 150 m from the production stopes.

Waste backfill materials will be either back hauled from surface waste rock pile or the DMS plant to remuck bays, or hauled from underground waste development headings using 30-tonne ejector type truck to remuck bays. An LHD will place the RF in the stopes. An LHD equipped with a Rammer Jammer (see Figure 49) will be used in the cut and fill stopes to achieve as tight a fill as possible. A dedicated LHD and truck will be assigned to backfill delivery.

Trucking depths will range from 50 to 1230 m below surface. The truck requirements will vary from early year production of 4 trucks at shallow depth to late year production of 9 trucks at greater depth based on an average fleet utilization of 3,400 hours per year per truck.

Mine Ventilation

SRK estimated the total air flow required for the Halfmile underground mine based on the utilization of the planned mining equipment plus contingency. New Brunswick mining regulations require a ratio of 0.066 cms per kW of engine power. This is equivalent to 105 cfm per engine hp. SRK estimated ventilation requirements at 330 cms or 700,000 cfm for a peak production rate of 2,800 t/d (Table 75). It should be noted that major ventilation airways and main fans were sized based on achieving 385 cms or 815,000 cfm airflow requirements, which provides an 18% contingency at the peak production.

Planned initial ventilation is based on the existing FAR, which was equipped with a 260 kW (350hp) variable speed fan forcing fresh air into the mine through a 20 MBTU mine air heater. This equipment was capable of providing up to 118 cms (250,000 cfm), but has since been removed and sent to Caribou Mine and will need to be replaced prior to restarting the mine. This system will be extended by driving 3 x 3 m Alimak raises, which are equipped with secondary egress ladders and are intended to support mining of the Upper zone and ramp development. The existing raise is not big enough to support mining of the Lower or Deep zones by itself.

A second, larger FAR will be developed to support production from the Lower and Deep zones. This new 5 m diameter (16 foot) raise will be developed by raiseboring in sections and will be capable of providing a maximumof 385 cms (815,000 cfm) to the Lower zone. The relatively flat dip of the ore

body limits the practical length of the raise sections as the cost and time to develop the ventilation transfer drifts is proportional to the raise length.

An initial estimate of the main fans and mine air heaters required for the new FAR calls for twin 600 kW (800hp) variable speed fans and 60 MBTU mine air heaters to support the maximum duty of 3385 cms (815,000 cfm). It is expected that the initial installation will be one fan and associated mine air heaters, with the second fan and mine air heaters being added in parallel several years later.

An internal Alimak raise system similar to the existing FAR will be developed level by level and connected into the new FAR at intervals to provide local fresh air to the Lower zone and Deep zone levels. As the velocities in these raises will be high, a separate smaller Alimak raise system is proposed to carry the secondary egress ladderway.

In addition, a new 4.5 m diameter RAR system will also be developed in parallel to the new FAR system. This is required to keep the air velocity on the ramp below the threshold for creating excessive dust. Excess return air from the ramp will be directed into the RAR system and discharged to the surface.

Table 75: Planned Mining Equipment and Ventilation (2028)

Underground Equipment	Peak Unit	Required (cfm/hp)	hp per Unit	cfm per Unit	Derating Factor	cfm Required
14-Tonne UG Scoop	6	106	353	37,418	50%	119,738
45-Tonne UG Truck	8	106	589	62,434	60%	299,683
30-Tonne UG Truck	2	106	408	43,248	60%	51,898
120M Grader	1	106	138	14,628	50%	7,314
Jumbo (Boomer 282)	3	106	78	8,268	10%	2,480
Jumbo (one boom)	1	106	78	8,268	10%	827
Scissor Lift	2	106	116	12,296	50%	12,296
Buggie Drill/StopeMate	1			8,000	50%	4,000
Boom Truck	2	106	246	26,076	50%	26,076
Toyota Man Carriers (Crews)	2	106	128	13,568	40%	10,854
Truck c/w Boom	1	106	99	10,494	50%	5,427
Toyota Truck (Technical)	1	106	128	13,568	40%	5,427
Toyota Truck (Shifters)	2	106	128	13,568	40%	10,854
Toyota Truck (Electrical)	1	106	128	13,568	50%	6,784
Toyota Truck(Mechanical)	1	106	128	13,568	50%	6,784
Tractor UG Forklifts	2	106	71	7,526	50%	7,526
BTI Rockbreaker/Blockholer	1					
Mechanized Bolter	3	106	147	15,582	40%	18,698
Shotcrete Unit	1	106	201	21,306	40%	8,522
Emulsion Bulk Loader	2	106	147	15,582	40%	12,466
ST3.5 Scoop	1	106	182	19,292	20%	3,858
Fuel/Lube Truck	1	106	147	15,582	60%	9,349
No. of Units in Fleet	**47**					
				Calculated cfm		**630,683**
				Leakage	10%	63,068
				Required (Rounded cfm)		**694,000**
				Required in Cubic Metre per Second (Rounded cms)		**330**
				Designed (cfm)		815,000
				Designed (cms)		385
				Contingency		**18%**

Backfill Method

A total of 2,472 kt of waste rock for backfill will be available from underground development waste for use as backfill which accounts for 48% of the total requirement of 5,162 kt. The remaining 2,690 kt will be back hauled from the Stratmat DMS reject waste rock for use as backfill.

Overall, it is expected that the split between cemented rock fill (CRF) and rock fill (RF) will be roughly 50:50.

Cut and Fill Methods

The 5480L and 5450L PPCF stopes have already been established with unconsolidated RF in the first cut, these will be completed using unconsolidated RF. The sill pillars under these stopes will remain as permanent pillars.

The 5420L and all future cut and fill stopes will benefit from the use of CRF. The initial cut will be filled with a good quality CRF containing 10-15% binder which will allow for at least 50% recovery of the sill pillar underneath. All subsequent cuts will be filled with unconsolidated RF until the sill pillar is reached. The cut directly under the sill pillar will be filled with unconsolidated RF and consolidated RF in order to tight fill under the sill pillar and provide confinement to the pillars. The sill pillar will then be extracted and filled with unconsolidated RF and consolidated RF as required.

MCF areas will be dealt with in a similar fashion.

Longhole Methods

Backfilling of the longhole stopes will follow a fairly typical process. A barricade made of rockfill will be placed across the drawpoint. Depending on the situation, the stope may then be filled with CRF, RF or a combination. Generally, all primary stopes will need CRF, and secondary stope will use RF or CRF, depending on location and sequencing of the particular stope.

A small number of voids may be left empty, designated as storage for slimes from mucking out sumps, designated as water storage (surge capacity or water recycling) or filled with excess RF.

Mine Dewatering

Pre-Development Dewatering

Dewatering of the Halfmile Mine is to proceed in parallel with pre-production activities, in preparation for the re-opening of the underground facilities. Currently, untreated mine effluent is pumped via a pump in the main ramp to the water treatment facilities.

As mining levels are dewatered, sumps are installed and sludge is removed, rehabilitation may proceed to these areas and coincide with the remainder of mine dewatering activities (with consideration for proper ventilation).

Steady-State Dewatering

Life of mine dewatering activities will consist of main sump stations with clear and dirty water sumps located on main levels at roughly 100 m vertical intervals on the bottom level of each mining block. Local dirty water sumps will be located on all sub-levels (at 30 m intervals in the Upper zone, at 20 m intervals for the Lower and Deep zones), with all dirty water flowing to the main level sump station below via drainholes and/or pipelines. These main sumps will then clarify the water and stage pump the clear water to the next main sump 100 m above via boreholes and/or pipelines. At this time, the dewatering system has not been sized or designed beyond what was installed for the 2012 trial mining.

Auxiliary dewatering activities will take place during mining activities to keep mining faces free from water, in the form of low hp electric pumps or pneumatic pumps.

Maintenance Facilities (surface/underground)

Maintenance facilities for the mine mobile fleet will consist of the existing surface repair shop supplemented by several underground service/tire bays to be installed as the mining progresses. An underground fuel and lube bay will also be installed in the vicinity of the Lower zone. The surface maintenance shop is in place and was observed to be in good condition during SRK's site investigation.

Electrical Power Distribution

Power to support the mine infrastructure will be supplied from Stratmat main substation, where under a new long-term contract New Brunswick Power Transmission Corporation (NB Power) will provide power from the power grid to the Stratmat main substation. Based on NB Power's policy, Trevali will qualify for a new user's incentive program that is now in effect.

Surface Temporary Plant Feed Storage

There is an existing plant feed storage area that was established for the 2012 trial mining. This "Ore Pad" is located 250 m from the portal with an approximately 4,000 m² area which meets the requirement for temporary plant feed storage. There is additional room available to expand in the future if required.

15.14 Stratmat Project Equipment, Services and Infrastructure

15.14.1 Stratmat Project Contractor Involvement

As the intent is to establish an owner operated mine, contractor involvement will be kept to a minimum.

There are several services where it is advantageous to contract out. The largest contract will be the Stratmat initial development

15.14.2 Stratmat Project Underground Mine Equipment

Table 76 shows the planned underground mining fleet, including the surface units required to support the mine plan. The maximum number of units is shown for each equipment type, and these numbers vary throughout the mine life, especially trucks.

15.14.3 Stratmat Project Mine Services and Infrastructure

Site Development Plan and Major Infrastructure

Stratmat Mine site development plan is part of Stratmat site (mine, DMS plant, etc.), see Section 17 in details.

Major mine related infrastructure includes main ventilation system fans and heaters, temporary waste stockpiles, mine office and mine dry, workshop, cement silos, etc.

Definition Drilling

A definition drilling unit cost of $0.50/t plant feed is included in the PEA. A detailed drilling plan has not been prepared. Considering that approximately 80% of targeted mineralization is in the Indicated mineral resources categories, which will require less definition drilling, it is SRK's opinion that the planned unit cost for definition drilling should be sufficient for the Stratmat Mine.

Table 76: Stratmat Planned Mining Equipment

Underground Equipment	Peak Units	Comment
14-Tonne UG LHD	4	
45-Tonne UG Truck (Dump-Box)	3	Haulage
30-Tonne UG Truck (Ejector-Box)	1	Rockfill
120M Grader (CAT)	1	
Jumbo 2 Boom	2	
Jumbo 1 Boom	1	Lease
Scissor Lift	1	
Buggie Drill (Stopemate)	1	Cable Bolting
Longhole Drills (Tophammer or ITH)	2	Contractor
Boom Truck	1	
Toyota Man Carriers (Crews)	2	
Minecat c/w Boom	1	Survey
Toyota Truck (Technical)	1	
Toyota Truck (Shifters)	2	
Toyota Truck (Electrical)	1	
Toyota Truck (Mechanical)	1	
Tractor UG Forklifts	2	
BTI Rockbreaker/Blockholer	1	
Mechanized Bolter	1	
Shotcrete Unit with carrier	1	
Emulsion Bulk Loader	1	
6-Tonne UG LHD	1	
Fuel/Lube Truck	1	
Subtotal Underground	**33**	
Surface Equipment		
Dozer	1	Shared with DMS Plant
Surface Pickup Truck	5	Shared with DMS Plant
Surface Forklift	1	
Mine Rescue Vehicle (MINECAT UT99C)	1	
Wheel Loader	1	Shared with DMS Plant
Surface Loader for Backfill	1	
Surface Haul Trucks	2	Shared with DMS Plant
Subtotal Surface	**12**	
Total Underground & Surface	45	

Materials Handling

Primary access for workers and equipment will be via portals and declines from surface. This Main zone ramp will be developed down to the -340 m elevation (700 m below surface). The Main zone ramp will be driven down to the +40 m elevation (245 m below portal face)

The main ramp is designed at a maximum gradient of -15% with a cross section of 5.0 m wide by 5.0 m in height. The Main zone ramp is designed at a maximum gradient of -15% with a cross section of 4.5 m wide by 4.5 m in height. All plant feed and waste handlings will use 14-tonne LHDs loading

45-tonne or 30-tonne ejector box trucks. Trucks will be loaded at the level access intersection from remuck bays planned near the ramps and travel up the ramp systems to the Stratmat mill plant. Remucks will generally be less than 150 m from the production stopes.

Waste backfill materials will be either back hauled from surface waste rock pile, or hauled from underground waste development headings using 30-tonne ejector type truck to remuck bays. An LHD will place the RF in the stopes. A dedicated LHD and the development truck will be used for backfill delivery.

Trucking depths will range from 40 m to 700 m below surface. The truck requirements will vary from early year production of one truck at shallow depth to late year production of three to four trucks at greater depth based on an average fleet utilization of 3,400 hours per year per truck.

Mine Ventilation

SRK estimated the total air flow required for the Stratmat Mine based on the utilization of the planned mining equipment plus contingency. New Brunswick mining regulations require a ratio of 0.066 cms per kW of engine power. This is equivalent to 105 cfm per engine hp. SRK estimated ventilation requirements at 166 cms or 351,000 cfm for a production rate of 1,400 t/d for main production system (S1 Shallow/Deep zone, S0 zone, and S5 zone), and 42 cms or 90,000 cfm for the Main zone underground supplementary production. It should be noted that major ventilation airways and main fans were sized based on achieving 189 cms or 400,000 cfm airflow requirement, which provides a 14% contingency at peak production.

For the main ventilation system, fresh air will be delivered through the Main Ramp and a 3.6 m diameter fresh air raise. Exhaust air will be drawn through a 4.5 m diameter bored raise to the surface.

For the Main zone ventilation system, ventilation is designed at 42 cms (90,000 cfm) for this supplement production system. Intake will be through the Main zone ramp, exhaust will be through a 2.4 m diameter of raisebored RAR.

Backfill

A total of 1,581 kt of waste rock for backfill will be available from underground development waste for use as backfill which accounts for 81% of the total requirement of 1,946 kt. The shortage of 365 kt backfill material will be supplemented by back trucking Stratmat DMS reject waste rock which accounts for 19% of the total requirement.

Mine Dewatering

Life of mine dewatering activities will consist of main sump stations with clear and dirty water sumps located on main levels at roughly 100 m vertical intervals on the bottom level of each mining block. Local dirty water sumps will be located on all sub-levels, with all dirty water flowing to the main level sump station below via drainholes and/or pipelines. These main sumps will then clarify the water and stage pump the clear water to the next main sump 100 m above via boreholes and/or pipelines. At this time, the dewatering system has not been sized or designed in details but budgeted allowance has been incorporated in the cost models.

Auxiliary dewatering activities will take place during mining activities to keep mining faces free from water, in the form of low hp electric pumps or pneumatic pumps.

Maintenance Facilities (surface/underground)

Maintenance facilities for the mine mobile fleet will consist of a surface repair shop supplemented by several underground service/tire bays to be installed as the mining progresses. A small fuel and lube bay will also be installed underground.

Electrical Power Distribution

Power to support the mine infrastructure will be supplied from Stratmat main substation, where under a new long-term contract NB Power will provide power from the power grid to the Stratmat main substation. Based on NB Power's policy, Trevali will qualify for a new user's incentive program that is now in effect.

Surface Temporary Plant Feed Storage

All Stratmat plant feed will be directly trucked to Stratmat mill plant. Therefore, there is no need for temporary plant feed storage.

16 Recovery Methods

16.1 General

The RoM production will initially be subjected to primary and secondary crushing at the Stratmat mine site to reduce the rock size to a suitable feed for a dense media separation plant (DMS). This operation will reject barren material from the +3 mm size from the mill feed effectively increasing the mill head grade and reducing the overall operating costs of the concentrator. A Barely Autogenous Grinding (BAG) mill will be used for primary grinding followed by a conventional ball mill for secondary grinding to liberate the minerals to allow flotation to concentrate the metals to saleable concentrates.

Also included in the process flowsheet is the application of Isamills for regrinding which eliminates the use of steel media and the associated difficulties in subsequent cleaner flotation operations.

The grinding and flotation plant equipment has been sized to provide a capacity to treat nominally 3,000 tonnes per day of plant feed with a design factor of 8%. At this production, the annual throughput capability will be 1.12 million tonnes assuming operating at 92% of the time for 350 days per year.

16.2 Process Flowsheet

The process flowsheet is shown below in Figure 62 for the crushing and DMS circuits, Figure 63 for the grinding and lead/copper flotation circuits and Figure 64 for the zinc flotation circuit. The flowsheet has been developed based on industry standard practice for equipment availability and utilization.

16.2.1 Crushing and DMS Plant

For the this study it has been assumed that primary crushing, secondary crushing and screening will be contracted out. The crushed product will be fed to a covered stockpile with a live content of 4,000 tonnes and the DMS plant will be fed using two apron feeders in a tunnel under the stockpile at 175 tonnes per hour. The dense media process is expected to reject 22% of the mass of RoM material in a reject which will be suitable for producing backfill with the addition of the required amount of cement. As only the +3 mm fraction of the RoM material can be upgraded, the -3 mm fraction will be screened out on a wet screen, thickened and the thickener underflow pumped to the ball mill discharge pump box or to a lagoon if the DMS plant is operating and the main plant is down. DMS upgraded material will be conveyed to a second stockpile with a live content of 3,000 tonnes.

16.2.2 Primary Grinding

Design feed tonnage to the grinding circuit is 145 tonnes per hour. The BAG mill will operate in closed circuit with a vibrating screen recycling the +5 mm fraction back to the BAG mill. Screen undersize will flow to a secondary ball mill which will operate in closed circuit with 15-inch diameter cyclones and will grind the material to a P_{80} of 72 microns.

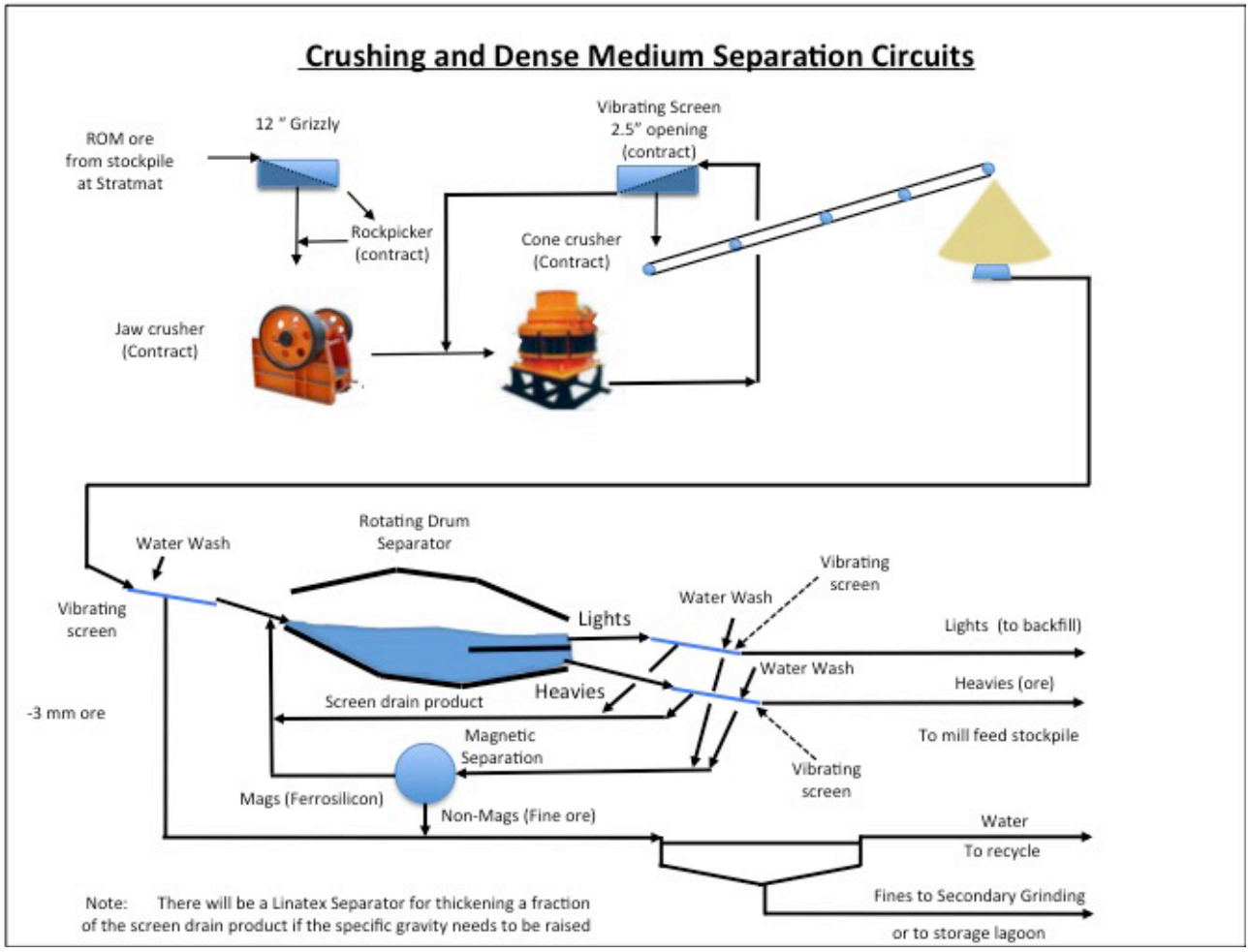


Figure 62: Crushing and Dense Medium Separation Circuit Flow Sheets

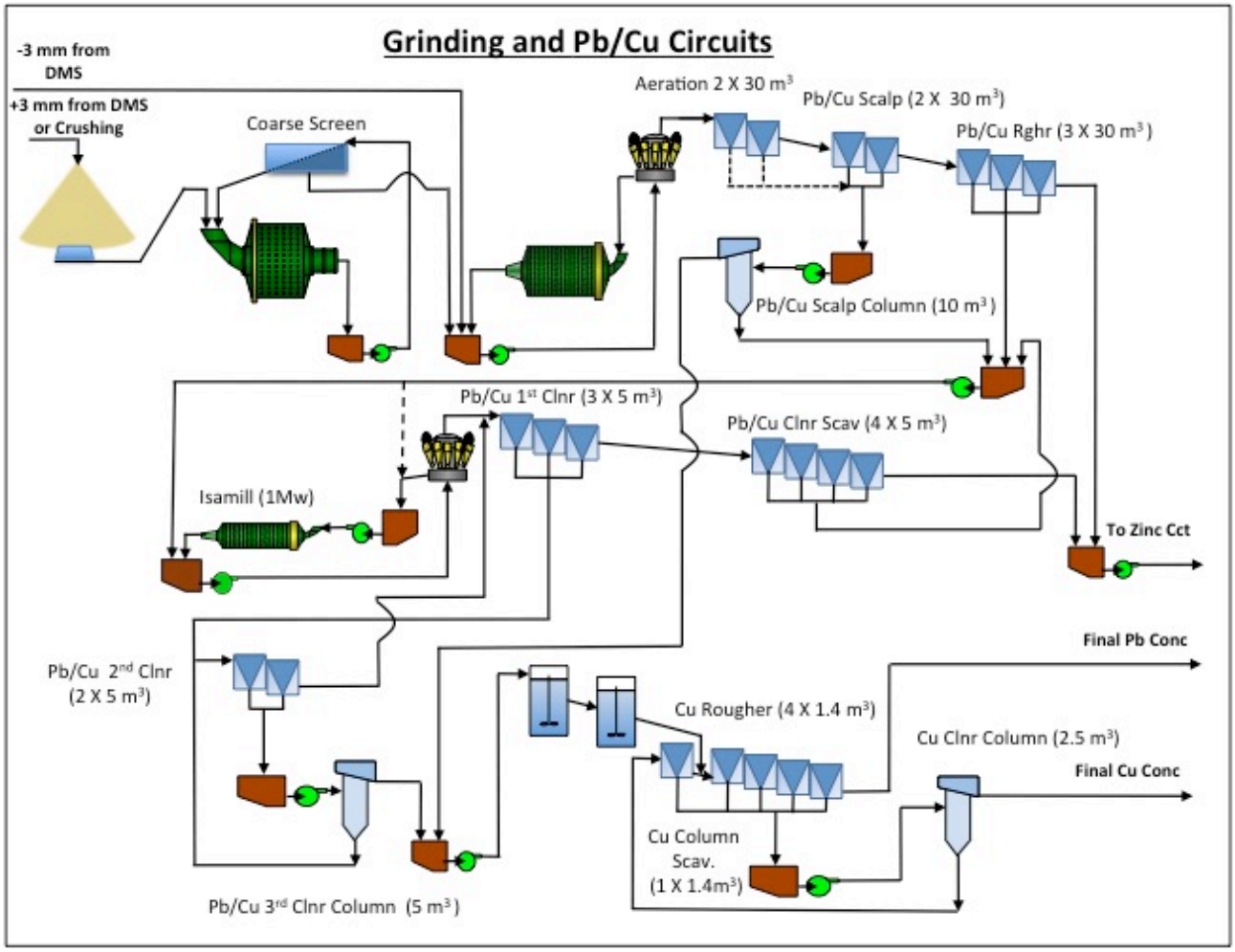


Figure 63: Grinding and Lead/Copper Circuit Flow Sheets

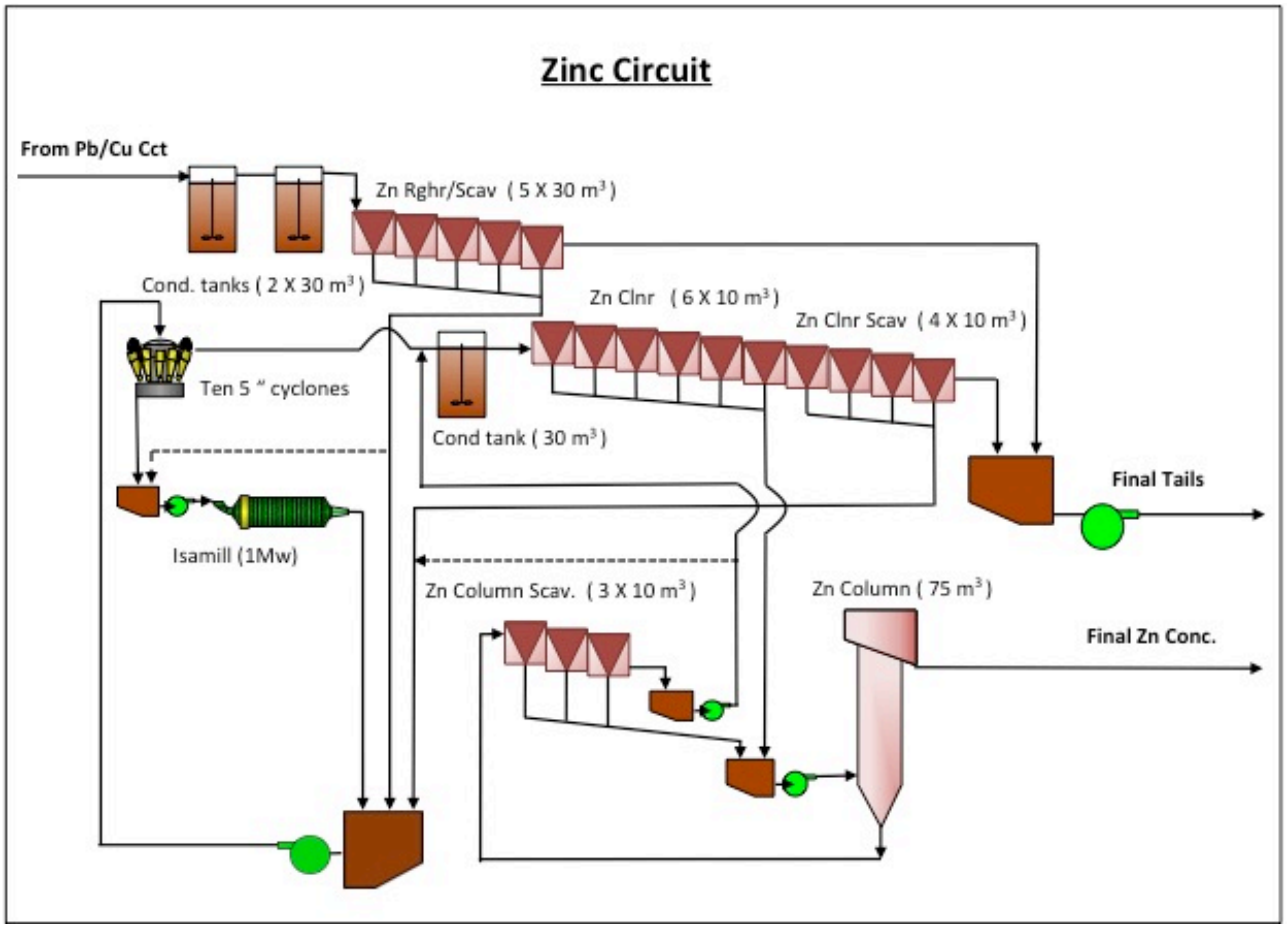


Figure 64: Zinc Flotation Circuit Flowsheet

16.2.3 Flotation

The ground material will be conditioned by aeration in flotation cells followed by Pb/Cu rougher and scavergener flotation with subsequent zinc activation and zinc rougher flotation from the tailings from the lead/copper flotation. Cleaner circuits will utilize Isamills for regrinding in both the lead/copper and zinc circuits. As noted above, this technology provides highly efficient grinding of fine concentrates and also largely eliminates the iron contamination of mineral particle surfaces as a ceramic grinding media is employed.

The lead/copper separation circuit design has been based on that used in the Brunswick mill with the exception of heating the process stream as it may not be practical at this location. To compensate extra retention time in the conditioning circuit has been included in the design. Column cleaning has been specified to provide efficient froth washing of the lead/copper and copper concentrates and recirculation sparging columns will be specified. Zinc rougher and first cleaner flotation will be carried out in conventional cells but, as with lead and copper cleaning, the final stage will be in a recirculation sparging column.

16.3 Halfmile Stratmat Concentrator General Operation Description

16.3.1 Crushing

The RoM material from both the Halfmile and Stratmat Mines will be received at the Stratmat site in a stockpile area near the crusher feed hopper. The RoM material will be loaded with a front end loader into that hopper from where, depending on the site topography, it will be either conveyed to or fall by gravity across a 12" grizzly. The grizzly will separate oversize that will be set aside for breakage by a rock breaker on a campaign basis. The crusher operation will consist of a primary jaw crusher and a secondary cone crusher with the secondary circuit closed by a 2.5-inch vibrating screen. The crushing and screening operation will be carried out by a contractor.

16.3.2 Dense Media Separation

The DMS plant will be located immediately adjacent and integrated to the primary grinding bay of the concentrator. The RoM material will be crushed and then conveyed to a stockpile with a live capacity of 4,000 tonnes. The stockpile will be covered with walls on three sides. The one open side will make the stockpile accessible to a dozer which will be used to increase the live capacity in freezing conditions. The crushed material will be reclaimed using two apron feeders that will discharge onto a conveyor in a tunnel. The reclaim conveyor will transfer the material to the DMS plant at a design rate of 175 tonnes/hour.

The crushed material feeding the DMS plant will be wetted in a conveyor discharge chute that will be designed to spread the material over the full width of the primary vibrating wet screen. The undersize (-3 mm) fraction from this screen will bypass the dense medium separator as its rise or sink rate in the heavy medium is too slow for it to be efficiently separated. It will report directly to a fines thickener. The coarse fraction will be mixed with the dense medium slurry (ferrosilicon) and laundered into a rotating drum separator with the dense medium held at a specific gravity between 3.0 to 3.2 which will cause the barren fraction of the material to float and the mineralized portion to sink.

Following the separation, the two products will report to discharge screens where the bulk of the dense medium will be drained from the mineralized and barren fractions. A second stage on the discharge screens will have high pressure water washing of the material to remove any remaining dense media. The upgraded mineralized material will be discharged onto a conveyor and report to the DMS product stockpile and the reject will be similarly discharged and conveyed to a covered 200 tonne loading bin from where it will be discharged to trucks for return to the mines. There will be an alternative discharge point to an open stockpile for use when trucks are not available.

The discharge screen washings will report to a magnetic separator where the heavy medium will be recovered in the magnetic fraction at high pulp density and report back to the heavy media feed tank. The non-magnetics, which are expected to contain only fine mineralized material that was not washed off in the initial screening, will report to the fines thickener. Thickener underflow will be pumped to the secondary grinding mill discharge pump box and thickener overflow will report to the process water tank from where it will be recycled to the process.

The thickener will be designed to have ample capacity for settled solids so that it can be used to retain the fines for a few hours if the grinding circuit is shut down and the DMS plant continues to operate. A lagoon will be made available so that the fines can be unloaded from the thickener if the DMS plant continues to operate for more than a few hours after the shut down of the grinding circuit.

A dense media upgrading circuit is included in the design to provide for returning the specific gravity to 2.95 by pumping a fraction of the dense media to a Linatex separator where excess water will be separated into the overflow and the high density underflow returned to the dense media feed pump box. Overflow from the Linatex separator will report to the magnetic separator where any dense media will be removed in the magnetic fraction. The non-magnetics will report to the fines thickener.

16.3.3 Comminution Circuit

The upgraded mineralization stockpile will be an insulated structure with 3,000 tonnes of live capacity to allow for operation of the mill during maintenance of the DMS plant or vice versa. A dump point will allow crushed mineralization to be added to this stockpile to completely decouple the operation of the mill from the DMS plant

Primary grinding will be in a BAG mill with a 950 kW motor. A BAG mill is required as the -65 mm maximum size of the mineralization means that there will be no lumps that are large enough to act as media for a semi-autogenous grinding (SAG) mill. A ball mill will not be used because a higher aspect ratio mill is required to ensure that the balls have sufficient energy to break the largest particles at a size that will also provide highly efficient grinding. A double-deck vibrating screen in closed circuit with the BAG mill is included with a designed opening of 5 mm on the lower screen.

Sodium carbonate (soda ash) for pH control and depressants (sodium cyanide and zinc sulfate) will be added to the BAG mill feed to ensure that depression of sphalerite and pyrite occurs as soon as the surfaces are exposed.

A conventional ball mill with a 2 MW motor in closed circuit with a cyclopac having eight 12-inch cyclones will take the BAG mill screen undersize at a P_{80} in the order of 750 microns and reduce it to the size noted above (P_{80} of 72 microns) for flotation feed.

16.3.4 Lead Flotation

Flotation feed will have frother (MIBC or equivalent) added and then be aerated in two 30 m^3 flotation cells which will provide a residence time of 12 minutes and will have the concentrate launders connected to the lead/copper rougher concentrate launder in case there is any concentrate produced from these cells.

Collector will be added into the feed box of the first lead/copper rougher cell.

Lead/copper rougher flotation will be carried out in two 30 m^3 tank flotation cells providing a residence time of 12 minutes and individual level control on each cell. This flotation will be carried out with minimal collector addition to minimize pyrite (FeS_2) and sphalerite (ZnS) recovery but recover the largely liberated and therefore fast floating galena (PbS) and chalcopyrite ($CuFeS_2$). Lead/copper rougher concentrate will be laundered to the regrind cyclone feed pump box.

Lead/copper scavenger flotation will be carried out in three 30 m^3 tank flotation cells with individual level control on each cell to provide optimal residence time distribution. Residence time will be 19 minutes and have individual level control on each cell. lead/copper scavenger concentrate will report to the lead/copper regrind cyclone feed pump box.

Regrinding of the lead/copper rougher and scavenger concentrates and the lead/copper first cleaner scavenger concentrate will be in a M4 (1MW) Isamill. Regrind feed will be pumped to a cyclopack

containing ten 4-inch diameter cyclones with cyclone overflow reporting to Pb/Cu first cleaner flotation and cyclone underflow reporting to the Isamill. The Isamill discharge will report back to the cyclopac feed pump box. The Pb/Cu first cleaner flotation will be fed from the Pb/Cu Isamill cyclone overflow and carried out in three 5 m^3 flotation cells all with individual level control and providing a residence time of 18 minutes. Lead/copper first cleaner concentrate will report to the second lead/copper cleaner cells while tailings go to the lead/copper first cleaner scavenger that consist of four 5 m^3 flotation cells which will give a residence time of 26 minutes. First cleaner scavenger concentrate reports back to the regrind mill as noted above while first Cleaner Scavenger tails report to zinc conditioning.

The second lead/copper cleaner will have two 5 m^3 cells which give a residence time of 23 minutes. This is an excessive residence time but two cells are required to provide sufficient froth surface area. It would be possible to use smaller cells with a better surface area to volume ratio but limiting the cell sizes used to just four (30, 10, 5 and 1.4 m^3 capacity) simplifies maintenance and reduces replacement parts inventory as well as reducing capital cost.

The second lead/copper concentrate will report to the third cleaner, a 5 m^3 capacity recirculation sparging column which again has to provide a long residence time in order to provide sufficient surface area. Column tails will report back to lead/copper second cleaner feed and lead/copper second cleaner tails report back to first cleaner feed rather than regrind because this material is expected to be already sufficiently fine to be fully liberated although provision will be made to send it back to the regrind mill if further grinding is required.

16.3.5 Copper Flotation

Dextrin at high pH and at elevated temperature has been used as a galena depressant and this would be the preferred approach for the Halfmile-Stratmat mill. As noted in above, heating the pulp may not be practical. To compensate, the retention time in the conditions will be almost one hour to allow the depressing reaction on the lead minerals to proceed. If the pH required turns out to be over 11.5, the lead/copper concentrate would have to be thickened and then diluted with lime containing water to minimize the precipitation of calcium carbonate which occurs when sodium carbonate laden water comes into contact with lime. The overflow from the copper and lead concentrate thickeners will be recycled to this circuit or discharged in a dedicated line to the tailings area. As all of the equipment in the copper/lead separation circuit is only slightly larger than that used in a pilot plant, the thickening and re-dilution steps should not be high cost and any potential budget outages should be covered by the contingency budget.

The circuit feed which is the lead/copper third cleaner column concentrate will be laundered to the first conditioning tank and flow by gravity through the second tank and into the copper/lead separation flotation cells. These cells will be a bank of 6 - 1.4 m^3 flotation cells, with the first cell used as the column scavenger and the second cell used as mix chamber where the circuit feed is added to the tails from the column scavenger. These cells will provide a residence time of 23 minutes in the rougher and 69 minutes in the scavenger. The 69 minutes is excessive but will provide ample capacity if the circulating load around the column is larger than expected. The 5 m^3 copper cleaner column is oversized for the same reason. The long retention time in the column (45 minutes) may help depress some of the lead and zinc minerals through surface oxidation. Additional metallurgical testwork may improve on the above specifications / anticaped performance.

16.3.6 Zinc Flotation

Soda ash and copper sulfate will be added to lead/copper rougher tails pump box. The rougher tails pump will discharge to the zinc conditioning agitated tanks which will be bottom fed and overflow

discharge. The tanks will have a combined capacity of 60 m^3 which will provide a conditioning time of 12 minutes.

The conditioned feed to the zinc roughers will overflow into five 30-m^3 tank cells. The residence time will be 30 minutes. All cells will have individual level control to ensure adequate residence time distribution. Zinc rougher concentrate will be laundered to the zinc regrind feed pump box and zinc rougher tails will be laundered to the final tails pump box.

The zinc regrind mill will be an M4 (1MW) Isamill operated in closed circuit with a cyclopac having 10 five-inch diameter cyclones. The Isamill is expected to treat 43 tonnes/hour of concentrate having a P_{80} in the range of 60 to 65 microns. The Isamill is expected to provide a zinc first cleaner feed with a P_{80} in the range of 15 to 20 microns. There is very little evidence that the cleaner feed needs to be ground this fine so that there is an opportunity for a cost reduction by optimizing the regrind mill size.

The zinc regrind cyclone overflow and the zinc column scavenger tails will be conditioned with copper sulfate and soda ash in a 30-m^3 conditioning tank identical to that used for zinc rougher conditioning. Retention time in the conditioner will be 15 minutes. The cleaner feed will flow from the conditioner by gravity to six 10-m^3 tank cells with cells 1–4 having common level controls in the downstream cell. The connection box taking the tails from the upstream to the downstream cell will have a small cross section to keep back-mixing to a minimum. Cells 5 and 6 will have individual level control systems so that there will be four “equivalent batch reactors” which will be more than adequate to provide a satisfactory retention time distribution for cleaner flotation. The six cells will give a residence time of 29 minutes. This is more than is required but is necessary, as with the copper/lead separation circuit cells, to provide sufficient surface area for froth drainage.

The zinc cleaner concentrate will be laundered to the zinc column feed pump box and the zinc cleaner tails will flow by gravity directly into the four 10-m^3 cleaner scavenger tank cells. These cells will have individual level controls so that there will be no back mixing and the retention time distribution will be satisfactory for a scavenging operation. The four cells will provide a retention time of 32 minutes with retention time again dictated by cell surface area rather than volume. Cleaner scavenger concentrate will report by gravity to the regrind mill feed pump box and cleaner scavenger tails will report to the final tails pump box.

A flotation column with a volume of 75 m^3 giving a residence time of 43 minutes has been specified for final cleaning of the zinc concentrate because of the higher upgrade ratio available with froth washing and the lower capital and operating cost compared to mechanical cells. The expected high grade zinc rougher concentrate at ~30% zinc will be upgraded to ~40% zinc in the cleaner circuit and then to ~50% zinc in the column. A high circulating load (300% based on the zinc in column feed to column concentrate) has been designed into the circuit because of the experience in other zinc circuits where columns have been installed for final cleaning. The column will have a pumped recirculation sparging system as for the lead and copper columns to improve the recovery of ultrafine particles. Zinc column concentrate will flow by gravity to the zinc thickener and zinc column tails will flow by gravity to zinc column scavenger flotation.

Two 10-m^3 tank cells will be required for scavenging high grade concentrate from the column tails and returning it directly to column feed. These cells will give a residence time of 37 minutes and there will be a high froth loading at 3 tonnes/hour/square meter but since upgrading will be fairly minimal (from about 41% to 45% zinc), this should not present a problem in operation.

16.3.7 On Stream Analysis

An allowance in the capital estimate has been made for an on-stream X-Ray Fluorescence or Laser-Initiated Breakdown spectroscopy (LIBS) analyser to analyse feed, lead/copper scalp and rougher grades, zinc rougher grade and all product and final rougher and zinc cleaner scavenger tailings grades for zinc, lead, copper and iron. A LIBS analyser would have the advantage of being able to analyse for sulfur in addition to the metals. It would be expected that the samplers designed for taking samples for the on-stream analyser would be of a type that would be suitable for taking accounting samples.

16.3.8 Concentrate Handling

As no testwork has been carried out on flocculation or concentrate settling rates, the thickeners have been sized based on those used at the Trevali Caribou mill. Those calculations indicate that the zinc concentrate thickener should be 40 feet in diameter, the lead concentrate thickener should be 25 feet in diameter and the copper thickener should be 12 feet in diameter. The lead and copper thickeners have a 50% design factor included because of the greater uncertainty of the grade of the concentrate that will be produced. A further safety factor arises from the finer grind at Caribou which will result in much lower settling rates for the Caribou concentrates.

16.4 Summary and Conclusions

Processing of the Halfmile and Stratmat RoM material in a DMS plant with the upgraded product conveyed to a concentrator can provide significant reductions in capital and treatment costs. If the mineralization is primarily massive sulfide with minimal dissemination of the values in the hosting gangue rock, DMS provides a low cost alternative to expending a large amount of energy in grinding to liberate low grade values, especially when those values are locked in gangue sulfides such as at Halfmile and Stratmat. Further test work is required on the Halfmile and Stratmat RoM material to prove that the mineralization bodies are amenable to DMS treatment. Confirmation of the rejection percentage will be important to the sizing of the concentrator capacity, particularly the grinding circuit where the higher capital is required.

The use of column flotation rather than mechanical cells for final cleaning of concentrates is expected to reduce the losses in cleaner tails and improve the operability of the circuit.

Recent developments with a staged flotation reactor (SFR) have shown good promise in improving selectivity in fine particle flotation. A commercial application has been incorporated in a lead-zinc operation in Alaska. These cells are much smaller tank cells of equivalent capacity and use about 50% of the energy and 10% of the air and can have very significant capital cost savings when installing them in a green field installation. This technology should be investigated in the next stage of development of Halfmile-Stratmat integrated project.

17 Project Infrastructure

17.1 Road and Access

Halfmile is serviced via a 23-kmunpaved road accessed adjacent to the Heath Steele property. This road was upgraded, bridges repaired and overall kept serviceable through the test mining project undertaken during 2011-2012. A gravel quarry was developed, blasted, crushed and used to top the surface of this road. Additional upgrading is required, namely a topping of ¾″ material for grading and contouring to manage a serviceable life over the project.

The Halfmile site roads were built for the full operational demands of a 2,000 t/d operation for the life of the planned projected mining life. These roads are maintained regularly during the spring through fall months as the site is maintained in a ready state, power generators and, water treatment are operated during the spring through fall period, shut for the winter months and monitored with camera and cellular service.

The Stratmat proposed project is within a km of the Heath Steele open pit access road. A new 1-km road will be built accessing the new infrastructure, mine and mill tying into the Heath Steele historical open pit road. Parking, roads, portal accesses will be built as required however the Stratmat site is dry and soil conditions favourable to road construction requiring limited quantities of topping material. Topping material will be produced from clean crushed construction waste during the pre-development waste construction of the mill and portal sites.

17.2 Administration Building

Halfmile offices and dry were developed as a rented mobile trailer complex. Replacing this set up will be a prefabricated complex to house the mine and surface requirements. The site will be serviced by senior staff from Stratmat; therefore, the requirement for staff at Halfmile is limited to operations of the mine, maintenance shop, warehousing and water treatment. Four 12′ by 40′ trailer prefabs will suffice for the admin and office complex. The dry will require reestablishment of the showering facility, the main clothes hanging and changing dry is still in place.

Stratmat complex for administration, engineering, warehousing, mill staff, mine management and surface staff will be a component of the mill complex. A 300-person dry will be built along with office space for 40 staff to encompass the various activities supporting the Halfmile and Stratmat needs. The facility is expected to have a minimum 10-year operation period from site construction through to mine closure and as such will be built with standard construction methods for a permanent industrial installation.

17.3 Core Shack

A central core shack will be required at Stratmat, core from both operations will be delivered to this facility for logging and assessment. The facility will be a 40′ x 60′ steel clad industrial building divided into various sections to facilitate the logging, mapping, cutting and sample prep areas.

17.4 Mill Plant

The mill complex will be constructed nearby the Stratmat Mine to precondition Halfmile-Stratmat run-of-mine material in the DMS plant then feed the economic product to the mill plant. For details, refers to Section 16.

17.5 Water Management Infrastructure

17.5.1 Halfmile and Stratmat Mine Water Treatment Plant

During the Halfmile test mining program an Actiflo water treatment plant with associated collection ponds was purchased and installed in sufficient capacity to treat the estimated life of mine inflows of 1,000 m^3 per day. Additional loads if encountered during the mine life can be managed by adding additional Actiflo cells. During testing the Actiflo system met or exceeded the water quality regulations.

The water management pond system in close proximity to the water treatment plant designed and installed at Halfmile holds mine and ARD pad water which is pumped from the mine area to the ponds through a 3-km underground HDPE pipe network, clean water is circulated back to the mine for industrial use. The ponds consist of a 10,000 m^3 mine effluent collection basin, a 20,000 m^3 treated effluent basin and a 1,000 m^3 sludge basin which collects the discharge from the water treatment process.

Stratmat will require a standard water treatment infrastructure for treating site and mine effluent. The system will consist of lime and flocculant addition, mixing tanks and pumping system to accept mine and surface water and deliver to sludge ponds adjacent to the tailings basin. Treated effluent will be released through a polishing pond as part of the tailings management infrastructure.

17.5.2 Potable Water and Waste Systems

Halfmile potable water systems were installed and are in use when the site is occupied in the summer months. Several wells were drilled and a potable filtration and treatment plant is located at each site, security, water treatment plant and mine complex. No further additions are required for full mining operations. Waste water is managed through septic systems again located at each location as required. The systems were built and permitted for full mine operational needs and can be expanded if required.

Stratmat will require potable water treatment plant sufficient to meet the needs of up to 300 persons. Standard treatment and filtration will be installed taking water from nearby fresh water sources. Waste will be managed through septic fields as in the case of Caribou and Halfmile.

17.5.3 Assay Laboratory Building and Equipment

An assay laboratory and associated equipment will be constructed at the Stratmat Mine. Core from Halfmile will be analysed in this laboratory along with core from Stratmat and the mill streams. A 40′ x 40′ standard steel clad building will be constructed for this purpose and be equipped with assay prep and analysing equipment.

17.5.4 Plant Feed Storage Areas and Pre-Process Equipment

Halfmile material to be processed along with Stratmat material will be stockpiled and blended at Stratmat concentrator plant site. A pad capable of one week's concentrator capacity storage will be constructed, lined and drained to the water treatment ponds.

Test work was completed on mineralized material sorting, removing a percentage of the waste non-sulphide material from the mill stream. Successful completion of the test and budget pricing including crushing, conveying, 2 sorters handling a fine and coarse fraction and feeding to the plant feed bins was included in the cash flow model.

17.6 Emergency Fire Fighting and Sprinkler System

The mill building and conveyor belts will be protected by an automatic combination wet/dry sprinkler system. Water will be stored in a 680 m³ (180,000 US gallon) tank with diesel and electric fire pumps. The fire pump and associated controls will be installed in an 8.5 m by 7.3 m heated metal clad, steel building.

17.7 Mobile Equipment Shop and Warehouse

The Halfmile site was constructed with a 2-bay shop and compressor building. For full production, a second shop will be required in the underground operation. The surface shop will be kept in operation for long term maintenance work. No warehouse is required, all material will be kept underground or on surface laydowns. An unheated sprung tent structure remains in place, 40′ x 60′ and is used to store materials for surface use.

Stratmat will require a warehouse and surface shop for primary preproduction period. Afterward the shop will move underground. For the temporary shop a 2-bay building with compressor room will be constructed close to the main mine portal and used for the duration of the project life. A warehouse will be constructed within the main mill structure.

17.8 Main Mine Ventilation Fans

Halfmile was constructed with a 250,000 cfm main fan, heater and vent raise for the Upper zone mining phase. The fan will suffice until two primary vent raises are driven to the Lower zone. The two raises will be fitted with fans and heater capable of 815,000 cfm to provide sufficient ventilation for the full fleet production equipment and the depth of the mine.

Stratmat will be fitted with a similar system as the Halfmile site, both sites will be operating the same size of equipment and similar fleet size.

17.9 Electrical Power

Heath Steele site is powered by the original NB Power line that service the site when operating. This line is 60 kV and capable of servicing Halfmile and Stratmat.

A 7.5 MVA substation will be installed at Heath Steele converting the 60 kV to 25 kV. From that substation, a 25 kV line will be run to Halfmile site where a transformer will be installed to convert to Halfmile voltage, 12.5 kV. All Halfmile electrical surface installation is complete and

serviceable. The underground mine infrastructure, main power cables and transformers were removed and are in storage ready to be reinstalled.

The power line at Heath Steele will be extended to the Stratmat Mine and plant site and converted to the necessary voltage to supply the plant and mine, individual transformers will be installed at Stratmat to supply the mine and plant.

17.10 Mine Compressed Air

Halfmile Mine compressors and reticulation system were installed in 2012. Two of the three compressors were removed and will require replacement. The mine compressors are located in the surface maintenance shop with underground pipes servicing the mine. The compressors are/were Sullair model LS-25 200LAC, 0.47 cms (1000 cfm) compressors, each driven by a 149 kW (200 hp) motor.

Stratmat will require a compressor system for mine and mill. The compressors will be located in the mill structure with separate units for the mine and mill.

17.11 Information Services

Halfmile telephones and internet is conveyed around the site via a fibre optic system. Radio modems connect the site system to the main provider.

A fibre optic line will be run to Stratmat from Miramichi to accommodate the requirements of Stratmat Mine and mill plant.

17.12 Required Infrastructure for Environmental Management

17.12.1 Septic Facility

Halfmile office complexes were equipped with licenced septic beds that will accommodate the full production planned staffing.

Stratmat will be equipped with a septic system, the system are acceptable in New Brunswick as environmental solutions to remote applications for mine and mill staff requirements.

17.12.2 Mine and Site Water Collection and Management Ponds

The Halfmile water management ponds and drainage was built to meet full operation compliance.

At Stratmat various small lined collection ponds will be constructed on site to manage mine water and site drainage and maintain environmental compliance.

- Mine water at each portal, to collect mine water and redistribute to underground or to the water treatment plant.
- Site drainage – as required to manage environmental compliance and distribute to the environment if the water meets regulatory discharge criteria or the water treatment plant if it requires treatment to discharge.

18 Market Studies and Contracts

18.1 Market Studies

Based on global demand-supply and long-term metal price forecast studies, Trevali and SRK conclude that zinc macro-fundamentals are positive with significant production closures in the past 12−18 months and over next 12−18 months anticapted. Global zinc demand continues to grow from approximately 1.5 to 3% per annum with consumption driven by global gross domestic product growth, urbanization/infrastructure development, and also as a “mid-cycle” commodity with expanding markets for consumer goods.

Consequently primary zinc supply is not sufficient to meet demand and the marco-zinc industry has entered a deficit scenario as of late 2015. This has further intensified following the recent closure to two global marquee mines, Century and Lisheen, in addition to the major mine production cuts announced by Glencore and Nyrstar.

Consensus forecasts point to a tightening zinc market over the next several years withzinc prices reacting positively.

With an approximate 3-million tonnes of forecast zinc consumption increase over next five years, it is estimated a zinc incentive price of US$3,600/tonne (US$1.60/lb) would be required to support the equivalent amount in new mine capacity to come online (based on Wood Mackenzie and LME Week Roundtable Discussion amongst industry participants).

Zinc concentrate with a planned grade of 50% zinc will be sold to smelters at normal industry terms, and a small iron penalty was assumed. Lead concentrate with a planned grade of 45% and will be sold to smelters at normal industry terms.

The metal prices of zinc, lead, copper, silver, and gold (not counted) used in the project economic analysis were provided by Trevali and reviewed by SRK based on current consensus long-term prices. It should be noted that current consensus prices are significantly lower than Wood Mackenzie forecasts for the period which forecasts $1.46/lb Zn for 2017 and $1.76/lb Zn for 2018 respectively.

18.2 Contracts

The following contracts will be part of the construction and/or operation of the Halfmile-Stratmat integrated project:

- Zinc, lead, and copper concentrate offtake agreements are in place with Glencore plc, a large, diversified resource conglomerate and commodity trader, for LoM feed at International Benchmark terms, as defined by average respective commodity price on the London Metal Exchange for the relative shipping period.
- Halfmile and Stratmat initial ramp and underground infrastructure will be conducted by mining contractors.
- Production drilling and blasting will be conducted by a well-established mining contractor throughout the life of the project. SRK understands that contract discussions by Trevali are well advanced.

- Halfmile RoM material will be transported to either the Stratmat DMS plant or Caribou mill by local contractor(s).
- DMS economic production (mill feed) will be transported by local contractor.

SRK has not reviewed any of these contracts or documents.

19 Environmental Studies, Permitting and Social or Community Impact

19.1 Existing infrastructure

19.1.1 Halfmile Project Mine Water Treatment Plant

The Halfmile water treatment plant is located 1.2 km west of the portal and is housed in a metal clad building. The mine water is treated via a sulphide precipitation process. The treatment system operates in three steps by: 1) precipitating, 2) clarifying/filtering, and 3) correcting the pH of the final effluent. The treatment plant is currently designed to treat a maximum of 42 m³/hr. The facility includes a hydrated lime dosage station, an Actiflo™ unit, a precipitation tank, and a pH correction tank, as well as several coagulant/polymer mix tanks and pumps. The basic layout of the plant is shown in Figure 65.

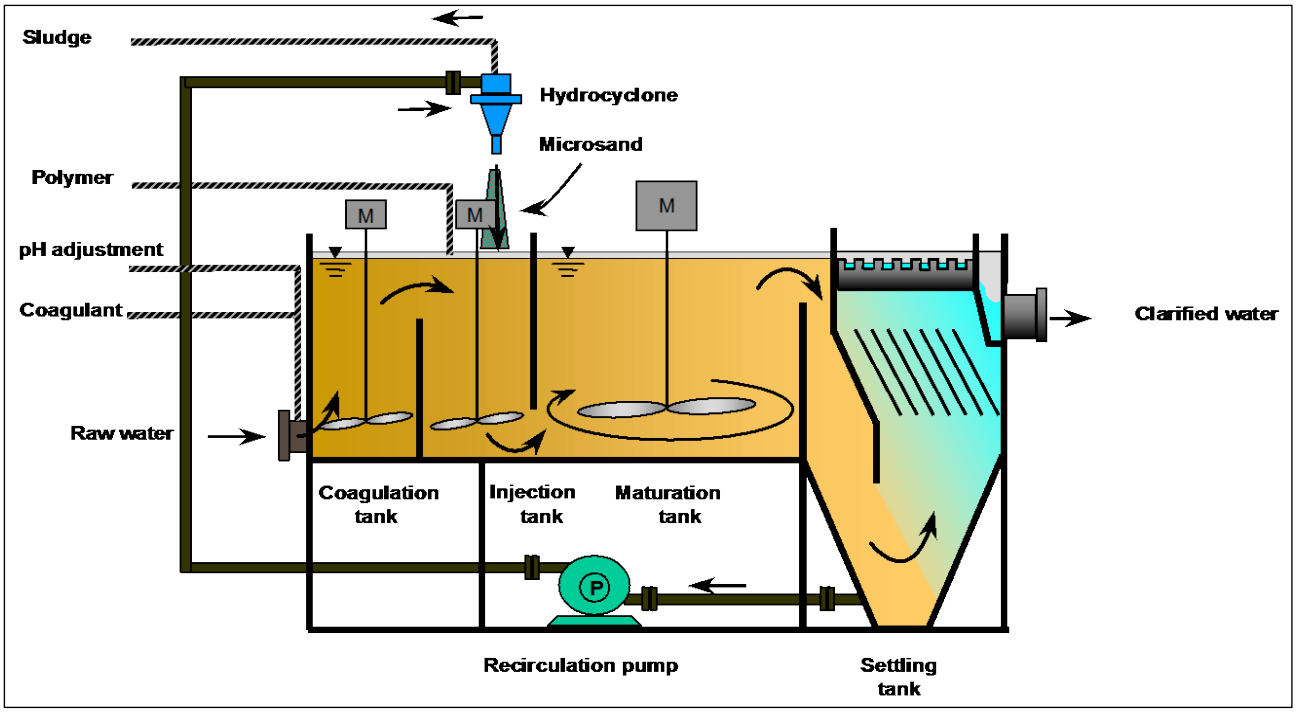


Figure 65: Halfmile Water Treatment Process Layout

Source: Veolia

Untreated effluent from the underground mine workings is mechanically pumped via an HDPE line (located along the main access road from the mine portal) to an HDPE-lined holding pond located near the water treatment plant. From this holding pond, the mine water is pumped to the treatment plant where lime, coagulant, and polymer are used to treat the water. Sludge produced during the treatment process is in part recycled back into the process, while the remaining sludge is stored within a small HDPE-lined sludge pond. Treated water is either stored on-site in an HDPE-lined pond or is directly discharged to the receiving environment via an underground baffle structure. The

final treated effluent remains underground where it eventually drains and disperses within the Moody Brook watershed. The effluent is treated to limits specified in the Halfmile Approval to Operate.

19.1.2 Sewage Treatment Facility

Halfmile currently has an on-site septic tank and sub-surface disposal field equipped to handle the domestic sewage requirements for an 80-person workforce.

Prior to the start of mining at Halfmile, the sewage facility should be cleaned out, inspected and repaired/upgraded as required.

19.1.3 Waster Rock Storage Facilities

Currently, the Halfmile Mine has two permitted waste rock storage facilities (WRSFs). The first storage pad is located near the existing mine portal and is used for both RoM material and potentially acid generating (PAG) rock handling. This "portal rock storage pad" is lined with an HDPE liner, and all runoff from the pad is collected and directed to the underground mine where it is subsequently pumped to the holding pond and eventually to the mine water treatment facility for treatment. A maximum of 10,000 tonnes of mineralization/waste rock can be stored at this location. Every 1,000 tonnes of material is tested for sulfur content (as %S total) and for neutralizing potential/acid potential (NP/AP) ratio. According to the provincial Approval to Operate for the Halfmile Mine (identification number I-8692), Trevali may transport excess waste rock to the former Heath Steele Mine for temporary storage. While this was done during the last mining cycle, all of the waste rock transported to Heath Steele was trucked back to Halfmile for permanent underground disposal. A similar setup could be used for the future mining campaigns if required.

The second WRSF is located south of the mine water treatment plant. Only non-acid generating (NAG) rock which meets the %S total and NP/AP ratio requirements defined in the mine's provincial Approval to Operate can be stored at this location. A maximum of 100,000 tonnes of NAG is currently permitted to be stored on the pad. All runoff from the pad is directed to the main mine access road ditch before being directed to the environment. The runoff is sampled weekly for metals, pH, hardness and TSS.

Prior to the start of mining at Halfmile, both these pads should be inspected and repaired/upgraded as required.

19.2 Required Infrastructure - Stratmat

New infrastructure to be built at the Stratmat site is sketched in Figure 66 and summarized below:

19.2.1 Dense Media Separation Plant

RoM material from the Halfmile and Stratmat mines is to be processed through a DMS plant located at Stratmat at a proposed rate of 1.4 million tonnes per year. The DMS plant will be situated near the RoM material storage pad while the surface crusher will be located on the lined storage pad. The RoM material will be crushed prior to being fed into the DMS plant. The DMS process consists of removing the barren waste rock from the RoM material prior to r to being processed in the Stratmat mill (year 2-13) or shipping the DMS product to Caribou mine for milling in the alternative case scenario. The DMS plant will remove approximately 22% of waste rock from the RoM material which will be used to backfill the underground workings at both the Halfmile and Stratmat mines.

19.2.2 Mill

DMS product from the DMS plant is to be processed at a proposed 3,000 tonnes per day mill located at the Stratmat Mine site. The mill will produce an average of 661,000 tonnes of tailings per year which will be stored in the newly constructed Tailings Management Facility (TMF). During the LoM, a total of 8,600,000 tonnes of tailings will be produced.

19.2.3 Tailings Management Facility (TMF)

For the purposes of this PEA, a high-level site selection study was carried out to look at potential locations for a TMF and the space requirements to store the volume of tailings anticipated for the Project. This high-level study identified 4 potential TMF locations that would be suitable to handle the volume of tailings required (Figure 66). Option 1 was selected to base costing for the TMF because it has the highest cost, is located close to the proposed milling complex, has good expansion potential, lesser watercourse diversion requirements, is located in watershed headwaters, and can be developed with a view to directing any significant mine discharges and drainages towards the Nepisiguit River system that has no Atlantic salmon (i.e. above the power generating station), as opposed to the Miramichi River, which has Atlantic salmon. Due to the acid generating potential of the tailings, sub-aqueous tailings deposition was assumed to keep the tailings submerged during operations and closure and prevent acid generation.

As the project progresses a more detailed TMF Alternatives Assessment will be carried out following Environment Canada Guidelines, and a Schedule 2 Amendment under the *Metal Mining Effluent Regulation* will be applied for if needed (i.e. if the proposed TMF is within waters frequented by fish). As part of the Alternatives Assessment, locations and tailings disposal technologies will be evaluated to determine the most appropriate tailings management system for the project taking into account all environmental, technical, economic, and socio-economic factors.

The selected Option 1 TMF is located to the north of the mill site. The TMF will be formed by using natural topography to the extent possible, and by constructing two water retaining earthen dams in low-lying areas (Figure 66). The total volume of tailings storage is 4,000,000 m^3. It has been assumed that local glacial till can be used as a central core for the earthen dams, with a waste rock shell. A detailed geotechnical investigation and design will be completed to assess the foundations and stability of the dams as well as borrow sources of till in the area is adequate for the proposed dams. Tailings will be pumped from the mill to the TMF via an HDPE tailings pipeline and will be stored sub-aqueously. The TMF effluent will be collected and sent to the water treatment plant where it will be treated to meet regulatory standards prior to being discharged to the environment.

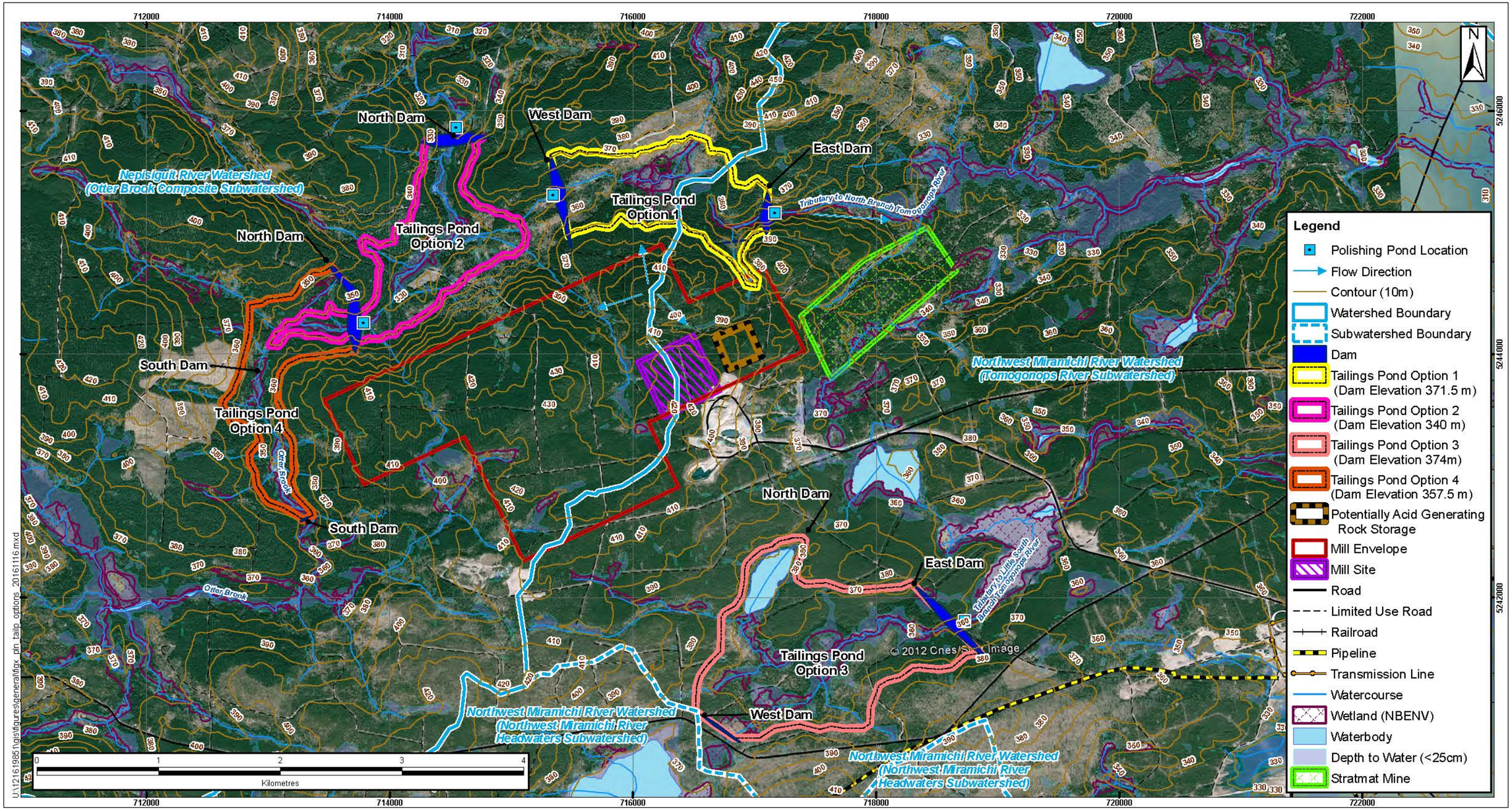


Figure 66: Stratmat Mine: Project Components

19.2.4 Mine Water Treatment Plant (Stratmat)

The Stratmat Mine site will produce mine effluent from its mining and milling operations. In addition, it is anticipated that the waste rock will be acid generating and therefore will also require treatment. A similar sulfide precipitation process as is currently used at Halfmile will be required to treat the mine effluent to meet regulatory standards. Site specific hydrology and hydrogeological modeling as well as a site specific water balance study will be required to determine water quality and volumes to be treated. Based on average annual precipitation rates and the nearby Heath Steele Mine site, a minimum water treatment rate of 10,000 m^3/day has been assumed for this study.

19.2.5 Sewage Treatment Facility

An on-site sewage treatment facility, or an on-site tank and sub-surface disposal field, will be required during the mining operation. Both options will be reviewed based on workforce requirements and regulatory requirements.

19.2.6 RoM and Waste Rock Storage Facilities (WRSFs)

Prior to being processed at the DMS plant, RoM material from the Halfmile and Stratmat mines will be stored on a RoM storage facility located near the Stratmat DMS plant. At this time, it is anticipated that a lined 12,000 tonne RoM pad will be required. RoM material will be dumped by haul trucks onto the RoM pad, crushed, processed in the DMS plant, and conveyed and processed at the Stratmat milling complex, or conveyed to another area of the DMS product pad where it will be loaded onto highway haul trucks and shipped to Caribou Mine for milling in the alternative case scenario (year 2-13). In year one, Halfmile RoM material will be trucked to Caribou mine using enclosed live bottom or enclosed back dump trucks which will prevent dusting and/or spillage from water contact.

Mine development waste rock from the Stratmat and Halfmile underground mines will be stored on two lined waste rock storage facilities (WRSFs) located at Halfmile and Stratmat, one at each site. Waste rock from DMS plant rejects will be stored on lined WRSF with a capacity of 881,000 tonnes located at Stratmat. DMS reject waste will be a supplement source of underground backfill.

While no formal testing has been conducted at Stratmat to define the nature of PAG/NAG waste rock, it is anticipated that all waste rock will be submitted to similar handling and identification conditions as was done at Halfmile, where the material will be tested for sulfur content (as %Stotal) and for NP/AP ratio to determine its disposal requirements. Waste rock will be dumped by haul trucks, spread by dozer, and compacted as necessary with a roller.

Waste rock will be used as required for backfill of the underground mines during the mine life at both Stratmat and Halfmile. Additional waste rock will have to be transported to Halfmile from Stratmat in order to meet the underground backfill requirements. It is anticipated no waste rock will remain at Halfmile and Stratmat at the end of the project life. In the event that waste rock would remain, it would be disposed of in the TMF for permanent disposal.

The RoM and WRSFs will require seepage collection systems to collect runoff from the storage areas. The effluent will be transferred to the TMF where all influenced waters will be sent to the water treatment plant for subsequent water treatment prior to discharge. NAG waste rock piles will be graded to allow for positive drainage directed off site.

19.3 Environmental Permits and Current Status

19.3.1 Provincial Assessment, Permit and Approval Requirements

Provincial environmental requirements to develop and operate the Halfmile Mine and the proposed Stratmat Mine and milling complex projects are specified in the New Brunswick *Mining Act* (Chapter M-14.1), *Clean Environment Act* (Chapter C-6), and the *Clean Water Act* (Chapter C-6.1). The *Mining Act* is administered by the New Brunswick Department of Energy and Resource Development (NBDERD), while the *Clean Environment Act* and the *Clean Water Act* are administered by the New Brunswick Department of Environment and Local Government (NBDELG).

Authorization to operate is controlled under the following main regulations:

- Under the *General Regulation* 86-98 - *Mining Act*, a requirement exists for the submission and approval of a "Program for Protection, Reclamation and Rehabilitation of the Environment";
- Under the *Environmental Impact Assessment Regulation* 87-83 – *Clean Environment Act*, all "undertakings" must be registered under the regulation to determine if an environmental impact assessment (EIA) is required; and
- Various other regulations under the New Brunswick *Clean Environment Act*, *Clean Water Act*, and *Clean Air Act*.

General Regulation 86-98 – Mining Act

A reclamation plan for the Halfmile Mine site is currently on file with the Government of New Brunswick and was submitted October 6, 2010.

Similarly, a reclamation plan for the proposed Stratmat Mine site will be filed with the Government of New Brunswick prior to the commencement of construction activities.

Environmental Impact Assessment Regulation 87-97 – Clean Environment Act

The Halfmile and Stratmat projects are subject to the New Brunswick *Environmental Impact Assessment Regulation – Clean Environment Act* (referred to as the EIA Regulation).

On December 20, 2010, a Certificate of Determination (File# 4561-3-1253) was issued to Kria Resources (a predecessor company to Trevali Mining Corporation) under the EIA Regulation for the construction and operation of the Halfmile Mine project (Appendix A). At the time of writing, it is not anticipated that the resumption of mining activities at Halfmile would trigger a new project registration process, since the activities proposed at the site remain the same as previously approved and because an active Approval to Operate remains valid for care and maintenance operations at the mine. In the event that a new registration is required for Halfmile (i.e. major change in project activity), the process detailed below for the Stratmat Mine and mill would also apply.

The proposed Stratmat Mine and milling complex project is not currently permitted and will be subject to the EIA Regulation. The EIA Regulation requires that the proposed construction, operation, modification, extension, abandonment, demolition or rehabilitation of certain projects or activities, called "undertakings" and described in Schedule A of the Regulation, must be registered. Schedule A includes 24 categories of projects or activities, one of which is "(a) all commercial extraction or processing of a mineral as defined in the *Mining Act*". Therefore, the proposed mining and milling operations at Stratmat will need to be registered under the EIA Regulation, at minimum.

Following a review of the submitted EIA registration documentation by the proponent of an undertaking and the subsequent provision of information or responses to questions arising from the review of such documentation, the Minister of NBDELG will decide if the project can proceed directly subject to conditions ("Determination Review"), or whether a more comprehensive EIA is required ("Comprehensive Review"). Due to the larger scope of constructing a new mine, milling complex, and TMF at Stratmat, a Comprehensive Review will likely be required. However, this determination is made solely by the Minister of NBDELG in view of the magnitude of the project and the associated environmental effects, and there is no way to determine which outcome will result.

Should a Comprehensive Review be required, the Minister would issue draft guidelines which establish the scope of the EIA, which are finalized following public input. Terms of Reference (ToR) are developed by the proponent to outline the work plans that will be carried out to meet the final guideline requirements. Following finalization of the ToR, baseline and environmental studies are carried out to characterize existing conditions and provide predictions on environmental effects to inform the EIA. The EIA Report is prepared following the completion of baseline and any predictive environmental studies, and submitted to the NBDELG for review. Following response to questions and comments by the government reviewers, the EIA Report is finalized and released to the public for comment prior to a formal public meeting regarding the EIA. The Lieutenant-Governor-in-Council then either approves the EIA and the project can proceed, or rejects the EIA and either further information is provided or the project is abandoned.

Typically, the completion of a Comprehensive Review (should one be required) would take approximately 18−24 months or more following initial registration of the Project, depending on the level of regulatory diligence being applied and the timing for carrying out of time-sensitive biological studies that will be required to inform the EIA Report. However, recent experience with Comprehensive Reviews of mining projects in New Brunswick (in particular the Sisson project) has shown that this timeline may be optimistic and considerable additional time might be required to complete the process, depending on the nature and extent of environmental effects from the project, the degree to which the public, stakeholders and First Nations may support the project, or other factors. In the unlikely event that a Determination Review only is required, it could be carried out within 6-8 months or more, depending on the availability of information and the level of regulatory diligence applied to the project information by regulatory reviewers. However, neither the regulatory decisions, outcomes, or timelines associated with the completion of these processes are in the control of the proponent, and the requirements are highly subject to regulatory discretion, external influence (e.g., public intervention), and other factors.

Following the fulfillment of the EIA Regulation requirements, pursuant to the *Water Quality Regulation* (Regulation 82-126) under the *Clean Environment Act* and/or the *Air Quality Regulation* (Regulation 97-133) under the *Clean Air Act*, the construction or operation of a mine and mill requires an Approval to Operate to be obtained. Currently, the Halfmile Mine site is operating under Approval to Operate I-8692 conditions issued on April 24, 2014 to Trevali Mining (Maritimes) Ltd (Appendix B). Approval to Operate I-8692, which is valid until January 14, 2018, allows for the operation of the underground mine and the associated surface infrastructure, and defines terms and conditions (such as emission limits, discharge limits, testing and monitoring requirements, reporting requirements, and the like) that a facility must comply with as part of its construction or operation in order to remain in compliance with the regulations. An Approval to Operate will also be required for the Stratmat Mine property and would be issued following the issuance of the Certificate of Determination to proceed under the EIA Regulation. The Approval to Operate is issued pursuant to paragraph 8(1) of the *Water Quality Regulation* and/or paragraph 5(1) of the *Air Quality Regulation*, as the case may be.

Pursuant to the *Petroleum Product Storage and Handling Regulation* (Regulation 87-97) under the *Clean Environment Act*, a license which applies to the storage, handling and use of petroleum products for any facility capable of holding a capacity of 2,000 liters or more of petroleum products, is required. Currently, Trevali holds a petroleum license (#7313) at Halfmile, which is valid until September 30, 2017. A petroleum license will also be required for the Stratmat Mine site in the event that petroleum is stored at that location.

Historically, there has not been a requirement for an Air Quality Approval to Operate for the operation at the Halfmile Mine, as there are few emission sources associated with this operation. It is assumed, however, that the Stratmat Mine and milling complex will require an Air Quality Approval to Operate, primarily for emission sources associated with the mill.

In addition to the major approvals described above, other project related approvals may be required such as, but not limited to: mining lease; license of occupation; crown land lease; harvest permit; quarry permit; development and building permit; approval to install an on-site sewage disposal system; and watercourse and a wetland alteration permit.

19.3.2 Federal Assessment, Permit and Approval Requirements

Federal environmental requirements to construct and operate the Stratmat Mine site are specified in the *Canadian Environmental Assessment Act, 2012* (c. 19, s. 52), the federal *Fisheries Act* (c. F-14), and the *Canadian Environmental Protection Act* (c. 33).

The requirement for a federal environmental assessment (EA) under the *Canadian Environmental Assessment Act, 2012 (CEAA, 2012)* is defined by the *Regulations Designating Physical Activities* under *CEAA, 2012*. Under these regulations, a metal mine with an ore production capacity of 3,000 tonnes per day or more, or a metal mill with an ore input capacity of 4,000 tonnes per day or more, require a federal EA. While the throughputs for the mine and mill are expected to be below the EA triggers, the federal Minister of Environment may still, in his/her discretion, require a federal EA to be completed if there are real or perceived concerns about significant environmental effects, or in the face of extreme public pressure. If an EA under *CEAA, 2012* were required, there are regulated timelines for an EA under *CEAA, 2012*, typically in the order of 12 months of "government time" following initiation for a "Standard EA" or 24 months of "government time" for a Review Panel. These timelines include times during which action is required by the proponent, including the time during which baseline studies are being conducted or the EIA Report is being written.

In addition to potential requirements for federal EA, the *Fisheries Act*, as amended in 2012, may apply. The *Fisheries Act* is administered by Fisheries and Oceans Canada (DFO) and is the main legislation protecting fish and fisheries in Canada. Section 35 of the *Fisheries Act* prohibits the carrying out of a work, undertaking or activity that results in "serious harm to fish that are part of a commercial, recreational or Aboriginal fishery" (hereinafter referred to as "CRA fisheries") without first obtaining an Authorization from DFO. "Serious harm to fish" is defined in the *Fisheries Act* as "the death of fish or any permanent alteration to, or destruction of, fish habitat". Authorization under the Act requires that the proponent must offset any serious harm to fish that were part of, or supported, CRA fisheries such that the productivity of the fisheries is maintained or improved. An Offsetting Plan must accompany the application for authorization, and is evaluated by DFO following the "Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting".

Additionally, under Section 36 of the *Fisheries Act*, "no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish" without authorization. For mines, the requirements of Section 36 of the *Fisheries Act* are further defined and regulated by the *Metal*

Mining Effluent Regulations (*MMER*). The depositing of deleterious substances produced by mines (*e.g.*, tailings, waste rock) is addressed by the requirement for any new tailings impoundment in waters frequented by fish to be added to Schedule 2 of the *MMER* under the *Fisheries Act*. The prerequisites for obtaining a Schedule 2 MMER authorization are specified in guidance issued by Environment Canada, including the need for a complete assessment of alternatives to the proposed TMF. The specific requirements would require confirmation with regulatory agencies in parallel to the provincial and/or federal environmental assessments. Also, pursuant to the *MMER*, all mines and recognized closed mines are required to conduct acute lethality testing, effluent characterization, and Environmental Effects Monitoring (EEM). While Halfmile is not currently subjected to *MMER*, the Stratmat site will likely trigger the *MMER* since it will likely be discharging treated mine effluent. These will be important operational considerations and may dictate the need for extensive wastewater treatment of mine contact water.

The *Explosives Act,1985* (c. E-17), administered by Natural Resources Canada (NRCan), regulates the manufacturing, testing, sale, storage, transportation and importation of explosives. If explosives required for blasting are to be stored and handled on-site, a license under the *Explosives Act* would be required for any on-site storage magazine.

Pursuant to the *Environmental Emergency Regulations* (SOR/2003-307) under the *Canadian Environmental Protection Act*, a list of 174 substances are required to be reported to federal authorities and an environmental emergency plan including prevention of, preparedness for, response to and recovery from an environmental emergency with respect of a substance is required. Currently, the Halfmile Mine site is in care and maintenance and it is unknown if the site contains substances which would trigger the regulation. Prior to start-up, an on-site substance list is to be reviewed to confirm compliance with the above noted regulations. Furthermore, during construction and operation phases, both the Halfmile and Stratmat mine sites will be required to file an annual report (usually in June) under the federal National Pollutant Release Inventory (NPRI) if the reporting limit thresholds to submit an NPRI are surpassed.

Pursuant to section 24 of the *Nuclear Safety and Control Act*, all nuclear substances, sealed sources, and radiation devices require licensing and certification. Several nuclear devices may be required within the proposed Stratmat milling complex and will likely be subject to the *Nuclear Safety and Control Act*. Annual compliance reporting is also required under this Act.

It is noted that the above constitutes a listing of the main known regulatory requirements for the construction and operation of a mine, but is not to be considered all-inclusive. Trevali should seek confirmation of the required authorizations, approvals and permits with regulatory agencies prior to the development of the mine, and may wish to seek legal counsel to advise on these and other legal requirements.

19.4 Existing Environmental Conditions

Halfmile Project

The environmental setting was previously described and assessed by BEAK Consultants Ltd. (BEAK) for similar project proposed by a previous owner of the property. The study presented information regarding terrestrial resources (soils, vegetation, and wildlife), water resources (hydrology, water quality, and sediment quality), and aquatic biota (habitat, benthos, and fish community; BEAK (1995) from Wardrop (2010)). The environmental assessment report (EAR) focused on the Halfmile Lake/Moody Brook watershed, draining north into the Nepisiguit River, and two small unnamed watersheds draining south into the Northwest Miramichi River (BEAK (1996) from Wardrop (2010)).

A desktop EIA Registration was completed for the Halfmile Mine property in 2010 (Wardrop 2010) in which the BEAK studies were relied upon for describing the sites environmental condition. The EIA Registration described and assessed the physical, terrestrial, aquatic and human environments. Those conditions are not reproduced here; the reader is referred to Wardrop (2010) for further information on existing environmental conditions near the Halfmile Mine.

Stratmat Project

The existing environment at the Heath Steele Mine (located 5 km from the Stratmat project) was previously described and assessed by BEAK for the Heath Steele Mine closure plan (BEAK (1997) from Wardrop (2010)). The study presented terrestrial resources (soils, vegetation, and wildlife), water resources (hydrology, water quality, and sediment quality) and aquatic biota (habitat, benthos, fish community, and in situ toxicity; BEAK (1997) from Wardrop (2010)). Since then, Heath Steele Mine closure activities have been undertaken. Surface infrastructure has been removed, with the exception of the water treatment facility while the TMF remains licensed and is currently under care and maintenance.

An EIA Registration (at minimum) will be required to construct and operate the Stratmat milling complex, TMF and mine. As such, an updated environmental baseline assessment (EBA) will be required to update the site's environmental information. In the summer of 2012 in support of an advanced exploration program related to the development of the Stratmat project, Stantec carried out field work in support of an EBA. While these results were not published due to the project being postponed, some of the information gathered during the 2012 field campaign have been summarized and are presented herein in conjunction with previous environmental studies conducted at Halfmile and at the former Heath Steele Mine site.

19.4.1 Land Use

The proposed Stratmat Mine is a zinc mining operation located approximately 5 km northwest of the former Heath Steele Mine (off of provincial Route 430), Northumberland County, New Brunswick, and approximately 55 km south of Bathurst. The project includes the development of a 1,600 tonne per day zinc mine at Stratmat, as well as the construction of a 3,000 tonne per day mill that would process DMS valuable product from Stratmat and the nearby Halfmile Mine and an associated TMF to store the waste products and contact water from the milling operation.

The proposed mine would consist of the Stratmat Mine, the location of the zinc mine itself; the mine site, where the initial processing of the mineralization (i.e., storage and crushing) will take place; the mill envelope, the potential area within which the ancillary facilities related to the mill will be located; and the TMF, the location for permanent storage of a waste material from the process mill.

19.4.2 Aboriginal Engagement

For Stratmat, First Nations will be engaged through early communication with Trevali's Mi'kmaq Benefits Manager. First Nations are already actively engaged in the Halfmile site. First Nations input will be sought on the overall engagement process for their communities and others that they may identify as being potentially affected by the Project. First Nations communities are constructed communities, and members who live outside of the community may have an equal interest in the Project to those currently residing within reservations. For this reason, Trevali will remain open to engaging with more First Nations communities or organizations, particularly if specifically requested to do so by any First Nation organization.

Aboriginal engagement will be initiated early and continue throughout the course of the provincial EIA review. As described above, Trevali will initiate discussions about the project with its Benefits Manager after registration of the project. Trevali will follow the direction and interest of the Benefits Manager and undertake engagement with the Aboriginal community in consideration of the wishes of the aboriginal communities of how they wish to be engaged, if at all. Trevali will also work with provincial, federal and municipal officials who will be conducting engagement with First Nations regarding the project.

19.4.3 Heritage Resources

In support of a potential EIA registration for the Stratmat Mine, Stantec conducted an Archaeological Impact Assessment (AIA) of the areas to potentially be affected by construction activities associated with the development of the mine and related ancillary facilities (e.g., TMF and mill site) in 2012. The field survey for the AIA was conducted under Archaeological Field Research Permit No. 2012NB31. The field survey was completed between October 11 and November 7, 2012, while the report was filed with the New Brunswick Archeological Services on April 23, 2013.

The 2013 report notes that the Project Development Area (PDA) falls within the traditional Mi'kmaq territory of *Gespegeog* who used both the coastal areas and interior waterways for travel, hunting and fishing. The Tomogonops and Nepisiguit Rivers in particular are mentioned in historical texts regarding use by the Mi'kmaq people living in the area. The name Tomogonops is derived from the Mi'kmaq word *Tumakunapskw* meaning "pipestone"; it is reported that during the early historic period Mi'kmaq visited the area to quarry sericite schist which was used to carve pipes. Tributaries to the Tomogonops flow through the PDA. During the archaeological impact assessment several areas with elevated potential for Pre-contact archaeological sites were noted and shovel testing was recommended to further investigate these areas.

During the historic period, there appears to be little documented use of the specific PDA location, with the exception of relatively recent forestry and mining activities. However it is important to note that general recreational use and traditional use by Indigenous people is rarely well documented, thus a lack of information on this should not be interpreted as evidence of a lack of use. Engagement with First Nations in the area, while attempted during the AIA, has not taken place in regards to this area, thus any information regarding current use by Indigenous peoples is not available at this time.

19.4.4 Noise and Air Quality

The Stratmat Mine site is located in an environment close to a secondary highway (Route 430), and is situated north west of the former Heath Steele Mine site. Existing anthropogenic noise sources in the area (as documented in 2012) include closure activities associated with the Heath Steele Mine, exploration activities related to the Stratmat claim area, forestry activities, road traffic and recreational activities from ATV/snowmobile trails and hunting.

The former Heath Steele Mine is the only heavy industry in the direct vicinity of the proposed mine site and background concentrations of air contaminants are expected to be minimal due to the closed mine status.

Stantec conducted baseline monitoring at the Trevali site over a seven-day period from August 28, 2012 to September 5, 2012. Ambient air quality monitoring and noise monitoring were conducted at a location near the southwest corner of the site.

Ambient air quality monitoring for total particulate matter, trace metals, sulphur dioxide and nitrogen dioxide concentrations were conducted.

Noise monitoring (sound pressure level monitoring) was conducted continuously over the seven-day period from August 28 to September 5, 2012 at the baseline monitoring site.

Based on the initial review of the data collected at the Stratmat Mine location, most of the samples collected were below the detection limit of the laboratory analysis. Thus, the preliminary general conclusion is that the data collected is reasonable and representative of conditions found in a rural wooded area in New Brunswick (Stantec Consulting Ltd. − Unpublished Data 2012).

19.4.5 Terrestrial Environment

The Stratmat Mine is situated within the Northern Uplands Ecoregion of the Atlantic Maritime ecozone. More specifically, the site is situated within the Tomogonops Ecodistrict, a gently rolling portion of northeast New Brunswick that is transitional between the mountainous Ganong Ecodistrict to the west and the low-lying Red Bank Ecodistrict to the east. The rugged hills along the western Tomogonops Ecodistrict border resemble the highlands of Ganong Ecodistrict and average about 500 m in elevation (NBDNR2007). The site is located in the northwest corner of the ecodistrict, at 325 to 435 m elevation above mean sea level (m amsl).

Terrestrial surveys were conducted at the proposed Stratmat Mine site in 2012 as part of an EBA completed by Stantec on Trevali's behalf. Surveys focused on the mine site, the mill footprint and the TMF, located due north of the mill. Surveys were conducted for birds, wetlands, and rare plants. Due to a downturn in metal prices, the EBA was postponed in 2013 and the results presented herein were not formally reported. The following sections present a high level summary of survey methods and results. Results may be subject to further analysis and investigation.

Aside from the field work conducted by Stantec in 2012, no formal wildlife and/or terrestrial surveys are known to have been conducted at Stratmat during the recent years. Several studies were conducted for the nearby Heath Steele operation in the 1990's. In 1995, Stratmat's environmental setting was described by BEAK where the study presented information in regards to the terrestrial resources, water resources, water and sediment quality as well as information on the aquatic biota (BEAK (1995) from Wardrop (2010)).

Birds

Bird studies completed in 2012 included early nester surveys in late April and early May, and breeding bird surveys during the peak breeding period of June and early July.

Early nesting surveys consisted of an evening survey in early May, with 8 stations surveyed along accessible roads in the vicinity of the project area and morning surveys consisting of 24 10-minute point counts. No species of conservation concern (SOCC) were recorded during these surveys. SOCC are here defined to include species that are not Species at Risk, but are ranked S1 (critically imperiled), S2 (imperiled), or S3 (vulnerable) in New Brunswick by the Atlantic Canada Conservation Data Centre.

Surveys conducted during the peak breeding period consisted of an evening survey, and early morning surveys of 30 10-minute point counts completed over 3 days in mid-June and repeated in early July. The evening surveys targeted common nighthawk (*Chordeiles minor*), a nocturnal species best detected in the early evening that is listed as "threatened" under Schedule 1 of the federal *Species at Risk Act* (*SARA*). This species was frequently encountered during the survey, with a total of 13 individuals recorded over 6 survey locations. Other bird Species at Risk recorded during the June surveys include Canada warbler (*Wilsonia canadensis*) and olive-sided flycatcher

(*Contopus cooperi*), both of which are designated as "threatened" under the federal *SARA* (Stantec Consulting Ltd. − Unpublished Data 2012).

Other Wildlife

Incidental observations of wildlife or their signs were made during the terrestrial surveys conducted in 2012. Mammals recorded include American beaver (*Castor canadensis*), black bear (*Ursus americanus*), snowshoe hare (*Lepus americanus*), mink (*Neovison vison*), red squirrel (*Tamiasciurus hudsonicus*), red fox (*Vulpes vulpes*), eastern coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), and moose (*Alces alces americana*). Herpetiles recorded include common garter snake (*Thamnophis sirtalis*), spring peeper (*Hyla crucifer*), and wood frog (*Rana sylvatica*). None of these species are considered to be SOCC (Stantec Consulting Ltd. − Unpublished Data 2012).

Rare Plants and Wetlands

Areas with elevated potential to support rare plants were identified during a site reconnaissance in May 2012; including valley bottoms with uncommon spring ephemerals, wetlands, and watercourses. There were wet areas that were determined to have potential for southern twayblade (*Listera australis*), listed as "endangered" by the Province of New Brunswick under the New Brunswick *Species At Risk Act* (NB *SARA*). Because this plant is ephemeral, targeted surveys were conducted opportunistically in early June 2012, simultaneously with bird surveys. No southern twayblade plants were found. Field surveys for wetland and vascular plants were conducted concurrently over one week in July and one week in August 2012, concentrated in areas deemed to have elevated potential. All vascular plant species encountered were recorded; no plant SOCC were found.

Wetland boundaries were delineated and information on wetland types, physical attributes, and functions were recorded. Where wetlands extended beyond the PDA, boundaries were interpreted using aerial imagery. Three wetlands were identified. No wetlands were identified within the mill site, two were delineated within the TMF area associated with a watercourse, and one was delineated within the mine site (Stantec Consulting Ltd. − Unpublished Data 2012).

Forestry

Generally applicable for New Brunswick as a whole, some of the species described below, may or may not be present in the immediate PDA area. Similar species may be found within the Stratmat PDA but were not formally surveyed during the 2012 field work.

The forested areas around the PDA are typical Acadian Forests with a mix of conifers and deciduous trees. Typical conifers found are red spruce, black spruce, white spruce, balsam fir, red pine, jack pine, eastern white pine, tamarack, eastern white cedar, and eastern hemlock. Deciduous trees include: yellow birch, white birch, paper birch, sugar maple, red maple, striped maple, balsam poplar, pin cherry, speckled alder, beech, black ash, white ash, butternut, ironwood, basswood, white elm, and red oak (Canadian Biodiversity Website, September 2016).

19.4.6 Hydrology

There is limited information available on the regional hydrogeology of the Stratmat area; however, based on a review of geological reports and topographic maps, it appears that the area is characterized by shallow surficial material overlying bedrock dominated uplands that have been incised by glacial erosion to form prominent valleys and bogs. The Stratmat project lies within a drainage divide: the proposed TMF includes Otter Lake and Otter Brook and tributaries, and the proposed mill site and polishing pond includes the tributaries to the North Branch Tomogonops River. The sub-drainage basin surrounding the TMF (Otter Brook composite) is 87.4 km^2 (drains to

the northerly direction) and the Tomogonops River Composite 166.3 km^2 (drains to the easterly direction) surrounding the Mill Site and polishing pond. The flow regime in the area is likely dominated by spring snow melt events, although periodic rainstorms can produce large discharges (Stantec Consulting Ltd. − Unpublished Data 2012).

Site-specific hydrology and hydrogeological modeling will have to be completed in order to develop a site-specific water management plan.

19.4.7 Aquatic Environment

Fish and fish habitat surveys were conducted in the summer of 2012 in support of an advanced exploration program at Stratmat. The proposed Stratmat site is located on the watershed divide of the Nepisiguit River (Otter Brook watershed composite) and the Miramichi River (North Branch Tomogonops watershed composite). The development of the fish and fish habitat assessment program for the property was based on the Project footprint. The field work portion of the fish and fish habitat sampling program was completed, but the results were never summarized and reported as the Project was postponed. However, in the event that Stratmat development is realized, the fish and fish habitat surveys were conducted to provide the baseline conditions for the Project site as may be required by an EIA. The information presented herein is a high level summary of the data collected.

Fish & Fish Habitat

Fish and fish habitat sampling was conducted to cover the requirements of the environmental assessments as well as the requirements for the *MMER.* Fish habitat was assessed within the proposed project footprint components (e.g., mine, TMF, Mill envelope). Additionally, sampling locations for a baseline ecological and environmental migration (EEM) program including detailed data collection (e.g., fish tissue, benthic invertebrate community) were selected based on the proposed Stratmat Project plan. The proposed project components are distributed on the Nepisiguit River and Northwest Miramichi River watersheds, detailed survey locations were therefore divided between the two watersheds. Ten fish and fish habitat sampling sites were located on Otter Brook, a tributary to the Nepisiguit River, and ten sites were located on the Tomoganops River, a tributary to the Miramichi.

All watercourses within the proposed project footprint were surveyed to determine the fish habitat present. A walkover of all the potentially affected watercourses wit+hin the project footprint was conducted to establish the type and quantity of habitat in the project area. In situ water quality measurements (pH, dissolved oxygen, temperature) were collected every 500 m to support the habitat assessment. Habitat surveys were done using NBDNR/DFO habitat forms. Approximately 5 km of watercourse were within the Project footprint, and were surveyed.

Results of the fish habitat walk over as well as the detailed baseline EEM habitat surveys conducted at each of the 20 baseline EEM sampling locations have not been analyzed. Generally, the walkover habitat surveys found poor quality fish habitat within the footprint of the proposed mine, TMF (Tomoganops and Otter Brook watersheds), and mill envelope. Watercourses in the proposed development area of the mine were headwaters or first order watercourses. These watercourses were small, heavily vegetated and frequently impounded by beaver activities. In contrast, habitat features at the baseline EEM sampling stations were second or third order watercourse and were primarily riffle-run. Baseline EEM sampling stations were selected to be similar in habitat structure and species present and were found to be suitable for all life stages of brook trout as well as several species of cyprinids. Baseline EEM sampling stations are outside of the mine development area and were selected based on either being downstream of the potential mine effects or outside the potentially affected area (Stantec Consulting Ltd. − Unpublished Data 2012).

Fish Tissue

Fish tissue data were collected for the baseline EEM and EIA studies for the purposes of fish usability for human consumption with respect to contaminant levels of mercury. A total of ten brook trout (*Salvelinus fontinalis*) greater than 10 cm in fork length were targeted for lethal sampling at three sites in each watershed. If the ten brook trout could not be captured at the given one site, the additional fish were gathered at the adjacent paired site. If ten brook trout could not be collected at the two paired sites, then no additional brook trout were retained from other additional sites. The number of brook trout targeted for lethal sampling was based on recommendations of the "Metal Mining Environmental Effects Monitoring Guidance Document" (Environment Canada 2012).

Baseline fish tissue studies were conducted at eight sites, four on Otter Brook and four sites on the Tomoganops River or associated tributaries. Tissue analysis was done on whole fish for mercury content, percent lipid, and percent moisture content. Comparison of these data was not conducted as the Project was put on hold. The intent of the baseline fish tissue studies was to record baseline mercury levels pre-construction as well as to identify and potential natural variation between the watersheds.

In total, nine different species were captured in both river systems these included Atlantic salmon (*Salmo salar*), brook trout, blacknose dace (*Rhinichthys atratulus*), blacknose shiner (*Notropis heterolepis*), common shiner (*Notropis cornutus*), creek chub (*Semotilus atromaculatus*), lake chub (*Couesius plumbeus*), pearl dace (*Semotilus margarita*) and white sucker (*Catostomus commersoni*). In total, 722 fish were sampled from the ten locations in the Tomoganops River watershed, and 489 fish were sampled from the ten locations in the Otter Brook watershed (Stantec Consulting Ltd. − Unpublished Data 2012).

A total of 35 brook trout were sacrificed for the purposes of fish usability baseline data. No analysis of the results has been conducted to date.

Benthic Studies

Benthic invertebrate community samples were collected at the 20 sampling stations using standard kicknet methods. Five benthic invertebrate samples (each sample representing a composite of three individual kicknet subsamples) were collected in the 2nd order stream downstream of the proposed TMF in both watersheds (i.e., 2 x 5 samples). Additionally, five samples were also obtained in the two 2nd order reference streams in both watersheds (i.e., 4 x 5 samples). Samples were sent to the laboratory for sorting and identification (Stantec Consulting Ltd. − Unpublished Data 2012).

Results were received from the laboratory but have not been analyzed as the Project was postponed.

Water and Sediment Quality

Water and sediment samples were collected concurrently with aquatic habitat surveys at each of the baseline EEM sites to help characterize habitat. A total of 12 water samples were collected in Otter Brook (Nepisiguit watershed) and 9 water samples were collected in the Tomogonops River (Miramichi watershed). The samples were sent to the laboratory for analysis (general chemistry, trace metals, mercury, total phosphorus, total nitrogen, total suspended and dissolved solids, and total organic carbon). For QA/QC purposes, water samples were accompanied by field duplicates, and field blanks.

Sediment samples were collected as part of each benthic invertebrate community survey completed. Sediment samples were collected at the same sampling stations as the fish and fish habitat surveys and at the same time as benthic invertebrate samples were collected. Sediment samples were

analyzed for particle size distribution and total organic carbon (TOC). Sediment samples were submitted to the laboratory for analysis of particle and grain size analysis and TOC. For QA/QC purposes, sediment samples were accompanied by one field duplicate for every ten true samples. Results of water and sediment quality were received from the laboratory but were not analyzed along with as the benthic invertebrate samples as the Project was postponed (Stantec Consulting Ltd. − Unpublished Data 2012).

Water quality monitoring at the Halfmile Mine site has been on-going for several years. The mine is subject to conditions set forth in the Approval to Operate and all discharged effluent from the site is required to meet approval guidelines. The mine has one designated final discharge location called the MH2/BA2 which leads to the infiltration diffuser outfall. This location is sampled daily when discharging for metals including zinc, copper and lead, as well as for pH, total suspended solids (TSS), hardness and ammonia. Weekly, quarterly and biannual water quality samples are also collected in Moody Brook, Halfmile Brook, in an unnamed tributary to the North West Miramichi River, the North West Miramichi River and the Nepisiguit River for trace metals, pH, TSS and hardness. In addition, nine monitoring wells located across the HM mine site are also monitored on a quarterly basis for trace metals, pH, TSS, hardness and acidity.

Based on their similar environmental setting and close proximity, it is anticipated that baseline Stratmat water quality will largely mirror baseline results found at Halfmile. As part of the proposed Stratmat project development, the EBA data collected in 2012 will require analysis and reporting and additional EBA work will be required to update the current environmental conditions found at the proposed project location.

Current and historical water quality monitoring data are on file at Trevali and can be made available upon request.

19.5 Environmental Capital Costs

The required environmental infrastructure costs associated with opening the Stratmat Mine are presented in Table 77.

Table 77: Environmental Capital Costs

Description	Estimated Cost	Notes
Equipment (lab equipment, truck, snowmobile)	$134,250	Estimate based on quotes
Water Treatment Plant (Stratmat)	$3,400,000	Estimate based on quotes
Septic Facility (Stratmat)	$250,000	Opinion of Probable Cost
Tailings Management Facility (Stratmat)	$10,000,000	Opinion of Probable Cost
RoM Storage Facility(Stratmat)	$50,000	Opinion of Probable Cost
Waste Rock Storage Facilities (Stratmat)	$500,000	Opinion of Probable Cost

19.6 Reclamation

19.6.1 Closure Phase

The closure phase is anticipated to include approximately three years beyond final completion of mining and ore processing activities. Post closure occurs beyond the three-year closure period and is the phase where site monitoring is carried out to demonstrate that the site is safe and closure designs are performing as intended.

Principles & Planning

A closure plan will specify the approach with respect to the progressive rehabilitation, decommissioning, removal, and disposal of site equipment and structures, and for site rehabilitation, closure, and care and maintenance of remaining facilities. It will also contain measures to achieve targeted environmental goals and will include a contingency to allow for shutdown at any time during the anticipated project life, if required. A final closure plan for both the Halfmile and Stratmat properties will be prepared and filed with the New Brunswick Department of Energy and Resource Development in accordance with the General Regulation 86-98 - Mining Act.

The objectives of closure are to establish a Project site that is:

- Self-sustaining
- Physically, chemically, and biologically stable
- Meets effluent surface water and groundwater quality criteria
- Revegetate areas of ground disturbance, where practical
- Meets the desired end land use and function, as it is defined through ongoing discussions with key stakeholders
- Meets applicable regulatory requirements.

Rehabilitation Activities

When practical, areas that are no longer required may be rehabilitated during mining operations. These activities, known as progressive rehabilitation, contribute to the overall rehabilitation efforts that would otherwise be carried out at closure, or efforts carried out in support of the closure activities (e.g., field trials).

Once the mines advance from the development stage to the operational stage, progressive rehabilitation activities can commence, as applicable.

Progressive rehabilitation opportunities may include:

- Removal of construction-related buildings, laydown areas and access roads
- Removal, stabilization and re-vegetation, where practical, of WRSFs
- Removal of hazardous and non-hazardous waste materials from site where possible on a regular basis

Closure

Closure rehabilitation is implemented after mining operation with the goal of reclaiming the site to support the desired end land use. While progressive rehabilitation activities will be carried out throughout the mine life, the majority of rehabilitation work will take place once mining has been completed.

The following list summarizes the main activities associated with closure at Halfmile and Stratmat.

- All infrastructure, equipment and mining materials (including buildings, milling complex, pipelines, site lighting and security, service water supply, water management facilities, petroleum products) are to be removed.
- Some facilities (e.g., access roads and the effluent treatment plant) may be required for the proper care and maintenance of the site during closure and will be removed/rehabilitated once they are no longer required during closure.
- The underground mines will be capped and allowed to flood.

- Any remaining WRSFs (not anticipated at this time) are to be stabilized, vegetated and capped with HDPE where required.
- The TMF at Stratmat is to be stabilized (chemically and physically).
- In preparation for revegetation efforts, the ground surface will be prepared by scarification or ripping of compact surfaces, making soil amendments to support vegetative growth, and implementing erosion protection measures to protect the soil cover until vegetation is established.

The majority of the closure measures are to be implemented over a three-year period after the cessation of mining and ore processing activities, however the TMF and the water treatment plant will remain at Stratmat as well as the water treatment plant at Halfmile. Both mines will be subject to a water quality monitoring program until they reach chemical stability. Capping and flooding of the underground mines at Halfmile and Stratmat and the subaqueous nature of the TMF may lead to long-term chemical stability. For the purpose of this PEA, a three-year post closure water treatment program at both Stratmat and Halfmile has been planned. Detailed water quality modeling studies will be required to determine if the three-year post closure treatment will be sufficient to achieve chemical stability. The properties will be considered to be in a state of post closure when the sites have been shown to be stable and able to meet the closure criteria.

Post Closure

The overall objective of closure is to return both the Halfmile and Stratmat properties to a chemically and physically stable state which is self-sustaining and supports the desired future land uses. The landscape will be revegetated using locally available, non-invasive plant species to encourage the return of wildlife and fish species to the area.

The sites will be monitored by Trevali according to a set schedule to verify that they are performing as expected and that effluent criteria are being met. Long-term physical stability of the TMF (dams and embankments) will have to be assessed in perpetuity (e.g. 100 years) via yearly dam inspections and every five years in the form of dam safety reviews as described under the Canadian Dam Association (CDA) guidelines.

For reclamation planning purposes and in the absence of supporting data at this time (data may become available from future studies) the proposed reclamation costs has assumed a post closure case of water collection and treatment for a three year period at Stratmat and at Halfmile since the tailings will be stored sub-aqueously (Stratmat) and that the underground mines will be allowed to flood and may achieve chemical stability during this period. To be noted that no data has been collected to support this statement and that if chemical stability is not achieved, that water treatment in perpetuity may be required at one and/or at both mine sites. Cost for water treatment in perpetuity is not included in the current reclamation cost estimate.

Alternative reclamation options may be explored once more information regarding the groundwater and bedrock conditions at the site are known.

19.6.2 Posting of Financial Securities

In accordance with the New Brunswick Regulation 86-98-*General Regulation of the Mining Act*, Halfmile and Stratmat mines require an approved Program for the Protection, Reclamation, and Rehabilitation of the Environment (also known as a Reclamation Plan). A Reclamation Plan was submitted for Halfmile under Kria Resources' name on October 6, 2010 to the New Brunswick Department of Energy and Mines (now NBDERD). The development of a revised reclamation plan

encompassing closure costs associated with both the Halfmile and Stratmat mines will be required prior to the commencement of operations.

The current reclamation assets on file for Halfmile Mine with the Province totals $325,160. Based on the current PEA reclamation plan cost estimates for both Halfmile and Stratmat, an additional $17,574,472 reclamation security bond would be required to be on file with NBDERD.

Reclamation securities can take the form of:

1) An irrevocable letter of credit;
2) Bonding by a third-party company; or
3) Cash

20 Capital and Operating Costs

20.1 Introduction

The Capital and Operating Cost Section will summarize the cost estimation for the Halfmile and Stratmat Mine and Mill Complex. The estimation includes the Halfmile underground mine with a pre-production period of 3.5 years (2019-2022) and the Stratmat underground mine with a pre-production period of 2.5 years (2019 to 2021).

20.1 Capital Cost Estimates

20.1.1 Capital Cost Summary

The project total capital costs are estimated at C$417.9 million ($M), including pre-production capital expenditures and sustaining capital expenditures.

The total pre-production capital costs for Halfmile Mine and Stratmat Mine are estimated at C$230.5M. This includes capital lease payments of mobile equipment, capital purchases of surface and underground infrastructure, capital development and for mine closure bonds. This is summarized in Table 78. All costs are in Canadian dollars ($C) and inclusive of a 25% contingency (the exception is reclamation capital at 30% contingency). The cost components are discussed further in the following sections of this report.

The ongoing, sustaining total capital costs for the remaining life of the combined Halfmile and Stratmat Mine complex life (following the pre-production period) is estimated at C$187.3M. This includes ongoing capital leasing of mobile equipment, ongoing rebuilds and improvements on surface and underground infrastructure, and ongoing capital development. This is summarized in Table 79. All costs are in Canadian dollars ($C) no contingency was applied to sustaining costs.

Capital costs were sourced from third party equipment manufacturers, contractors and vendors, SRK's internal capital database and from Trevali company personnel. The capital estimation was completed with an accuracy of +40%/-30%.

Table 78: Pre-Production Capital Expenditure

Description	Units	Halfmile	Stratmat	Combined
Mobile Equipment	$M	17.8	1.1	18.9
Capital Development	$M	31.5	25.1	56.6
Infrastructure	$M	24.5	130.5	155.0
Mine Closure*	$M		-	-
Total	**$M**	**73.9**	**156.7**	**230.5**

* Trevali informed that it has $30M line of credit in place, part of which will be used in mine closure bond

Table 79: Sustaining Capital Expenditure

Description	Units	Halfmile	Stratmat	Combined
Mobile Equipment	$M	21.7	19.7	41.5
Capital Development	$M	76.4	33.2	109.6
Infrastructure	$M	5.8	12.9	18.6
Mine Closure	$M	-	17.6	17.6
Total	**$M**	**103.9**	**83.4**	**187.3**

* Approximately split between Halfmile and Stratmat

20.2 Mobile Capital Equipment

The mobile equipment fleet consists of underground production and development units to support both the Halfmile underground mine and the Stratmat underground mine. Surface equipment is also included. All equipment will be leased under a capital purchase agreement signed with vendors with an assumed 20% discount on capital based on volume purchases. Lease will be based on a 4 year amortization at 4%. The estimated number of units required are 45 and 41 for Halfmile and Stratmat respectively. The total cost estimation for mobile equipment for Halfmile is C$17.8M for the pre-production period and C$21.7M for the sustaining production period. The total cost estimation for mobile equipment for Stratmat is C$1.1M for the pre-production period and C$19.7M for the sustaining production period. At Startmat, during the preproduction period, all primary equipment will be supplied by contractors.

Table 80 below provides a summary of the mobile equipment, the estimated number of units required for purchase for the LoM and the purchase discounted base price per unit before amortization.

Table 80: Mobile Equipment Fleet

Primary Equipment	Purchase Price* ($/unit)	Halfmile Number of Units	Stratmat Number of Units
LHD 8 Yd	$960,000	6	4
UG Truck 45 T	$1,120,000	6	3
UG Truck 30 T	$960,000	1	1
Grader	$428,000	1	1
Jumbo 2 boom	$784,000	3	2
Jumbo 1 boom	$436,000	1	0
Emulsion- Loader	$366,000	2	1
Top-hammer drill	$683,000	2	0
Mechanized Bolters -	$832,000	3	1
Ancillary Equipment			
Scissor Lift	$309,000	2	1
LHD 3.5 yd	$640,000	1	1
Cable Bolter	$189,000	1	2
Dry Shotcrete Unit	$480,000	1	1
Service Truck	120,000	n/a	1
Rockbreaker	640,000	n/a	1
Boom Truck	582,000	1	1
Personnel carriers	100,000	5	4
UG Forklift	195,000	2	1
Personnel Carries (Crew)	264,000	2	1
Personnel Carrier cw Boom (Tractor)	126,000	n/a	1
Mine Rescue	72,000	1	1
Fuel Truck	313000	1	1
Surface Equipment			
Track Dozer	$92,000	n/a	1
Loader for Backfill (Surface)	$544,000	1	1
Pick up Truck	$29,600	n/a	5
Forklift Surface	$44,000	n/a	1
Haulage Truck	$300,000	n/a	2
Wheel Loader	$216,000	n/a	1
Total		**45**	**41**

* Purchase Based Price

20.3 Capital Development

Capital development includes lateral development for both the ramp and level extraction. As well as vertical development for raises excavated by both raisebore and Alimak methods. For Halfmile approximately 9,476 m of lateral development and 1,265 m of vertical development will be required during the pre-production phase at a total cost of C$ 31.5M. For Stratmat approximately 2,206 m of lateral development and 243 m of vertical development will be required during the 2-year pre-production phase at a total cost of approximately C$ 25.1M

The details of development for the pre-production period are summarized in Table 81 for Halfmile Mine and Table 82 for the Stratmat Mine.

Table 81: Halfmile Underground Mine Capital Development (Pre-Production)

Capital Development Type	Dimension Size (m)	Unit Cost $/m	Total length (m)	C$M
Ramp	5.0 x 5.0	3,538	5,058	9.9
Level	4.5 x 4.5	3,078	4,418	14.7
Main FAR Raise	5.0m	8,750	317	2.8
Main RAR	4.5m	8,500	105	0.9
Manway	2.0 x 2.4	3,420	285	1.0
Manway	2.4 x 2.4	3,105	-	-
Internal FAR	3.0 x 3.6	4,050	558	2.3
Total			**10,742**	**31.5**

Table 82: Stratmat Underground Mine Capital Development (Pre-Production)

Capital Development Type	Dimension Size (m)	Unit Cost $/m	Total length (m)	C$M
Ramp	5.0 x 5.0	3,300	3,171	10.5
Level	5.0 x 5.0	3,300	2,233	7.4
Level	3.0 x 3.0	2,550	89	0.2
Raise – Raisebore	5.0	8,750	404	3.5
Raise – Alimak	4.5	8,400	418	3.5
Total			**6,316**	**25.1**

At Halfmile, lateral capital development will be completed by both contractors and company personnel. The unit costs are marked up by 15% for contractor work. The combined average unit costs are shown in the above table. At Stratmat, lateral development will be completed by contractor during preproduction period then transition to company personell. All vertical capital for both mines development will be completed by contractors.

At Halfmile, during the production period 17,781 m of capital lateral development and 3,427 m of vertical development is scheduled at a total estimated sustaining cost of C$ 76.4M. At Stratmat, during the production period 8,789 m of laterial development and 908 m of vertical development is scheduled at a total estimated sustauining cost of C$ 33.2M

20.4 Process Plant and Mine Infrastructure

The Process Plant and Mine Infrastructure cost summary includes the pre-production costs and its related ongoing sustaining costs to support the Halfmile and Stratmat Mine and Mill Complex. The costs include labour, materials, supplies and services for the establishment and ongoing project maintenance of the facility. This capital cost estimation includes various processes such as Project Indirects, Surface Infrastructure, Underground Mine Infrastructure, and the Mill Concentrator and Tailings Facility located at the Stratmat site. The total Process Plant and Mine Infrastructure cost during the pre-production period for Halfmile is C$24.5M and C$148.0M for Stratmat. The total sustaining costs are C$5.8M for Halfmile and C$12.9M for Stratmat. A summary is provided in Table 83 for both mines and the combined mill located at the Stratmat Mine site.

Table 83: Halfmile and Stratmat Infrastructure Cost Summary

Category	Combined		Halfmile		Stratmat	
	Pre-Production (C$M)	Sustaining (C$M)	Pre-Production (C$M)	Sustaining (C$M)	Pre-Production (C$M)	Sustaining (C$M)
Project Indirects	12.5	-	6.8	-	5.7	-
Surface Infrastructure	28.5	3.0	12.3	2.0	16.2	1.0
Underground Infrastructure	10.3	7.5	5.4	3.7	4.9	3.8
Mill Complex	103.7	8.1			103.7	8.1
Closure and Environmental	17.6				17.6	
Total	**172.6**	**18.6**	**24.5**	**5.8**	**148.0**	**12.9**

20.4.1 Project Indirects

The project Indirects includes the contribution of an EPCM and owner's team, project insurance, engineering design along with a Feasibility Study and a cost allowance for an EIS/EA all during the pre-production phase. The combined cost estimation for both mines sites is C$12.5M

Surface Infrastructure

Surface Infrastructure is inclusive of most activities related to surface construction. It includes the construction and commissioning of site preparation and building of roads, installation of power, ventilation, water distribution and establishment of the dewatering system, surface buildings and mine wide communications installation. The cost estimation during the pre-production period for Halfmile Mine is C$12.3M and C$16.2M for Stratmat Mine. The sustaining costs for Halfmile Mine is C$2.0M and C$1.0M for Stratmat Mine.

Underground Infrastructure

Underground Infrastructure is inclusive of most activities related to underground construction. It includes the construction and commissioning of refuge stations, sumps, powder and cap magazines, satellite maintenance facilities, electrical installations, process water and dewatering systems. The cost estimation during the pre-production period for Halfmile Mine is C$5.4M and C$4.9M for Stratmat Mine. The sustaining costs for Halfmile Mine is C$3.7M and C$3.8M for Stratmat Mine.

Mill Complex

The Mill Complex located at the Stratmat Mine site includes the DMS plant and Concentrator and the Tailings Management Facility. The cost estimation during the pre-production period is C$103.7M and C$8.1 during the production period.

20.5 Mine Closure and Miscellaneous

The mine closure plan described in Section 19.6. The mine closure costs for Halfmile and Stratmat are estimated at C$17.6M.

20.6 Operating Cost Estimates

20.6.1 Operating Cost Summary

For both underground mines, Halfmile and Stratmat, an operating cost model utilizing a factoring methodology was developed. This was completed by utilizing Trevali's Caribou Mine as the bases of estimation. In some cases, where mine activities were not available from Caribou mine, cost were then based on SRK's database of benchmarked data, with similar activities as that of the proposed mines. The benchmarked unit costs were then factored (increased up or down) to reflect Halfmile and Stratmat mines operation. A fixed and variable component was included thus allowing the costs to reflect the production rate of each particular year.

Operating costs include labour, supplies, services, power and mobile equipment maintenance and parts. The average operating cost per tonne mined for Halfmile Underground is estimated at $27.56/tonne and for Stratmat Underground at $9.34/tonne. The General and Administration costs for integrated project is estimated at $13.94/tonne and a processing costs of $21.04/tonne. These costs are summarized in Table 84. The total operating cost are estimated at $71.88/t-milled.

The average mine operating cost at each site for Halfmile Underground is estimated at $38.24/tonne and for Stratmat Underground at $33.44/tonne.

Table 84: Halfmile and Stratmat Mine and Mill Complex Operating Cost Summary

Area	Unit Cost	
	$/t mined at site	$/t mined (ave)
Stratmat Underground Mine	33.44	9.34
Halfmile - Underground Mine	38.24	27.56
Stratmat/Halfmile - G & A		13.94
Stratmat/Halfmile - Processing Cost		21.04
Total		**71.88**

20.6.2 Underground Mine Operating Cost

Underground Mine costs pertains to the operational costs to support the mineralization extraction at both the Halfmile and Stratmat mines. Both mines utilize a long hole open stope (LH) with backfill mining method. However, Halfmile also incorporates a post pillar cut and fill (PPC&F) method for 9% of the mineralization extraction. Underground mine costs are summarized in Table 85.

Table 85: Underground Mine Operating Costs

Activity	Stratmat UG Mine $/t	Halfmile UG Mine* $/t
Mucking	$3.02	$3.07
PPC&F		$1.41
Backfill	$5.11	$7.89
LH Drilling	$2.34	$2.15
LH Blasting	$2.01	$1.85
Operating developing	$4.38	$3.86
Truck Haulage	$1.00	$2.51
UG Services	$6.93	$6.93
Road Maintenance	$1.07	$1.07
Material Handling	$1.60	$1.60
Diamond Drilling	$0.51	$0.36
UG Maintenance	$5.49	$5.53
Total	33.44	38.24

20.6.3 General and Administration

General and Administration costs include the mine indirects that are not charged directly to the operating mines. It includes the administration at the main office located at the Stratmat Mine site as well as a smaller administration office at the Halfmile Mine site. Also included is the ongoing management and maintenance of the tailings facility and water treatment and tailings systems. Run of Mine (RoM) material from the Dense Media Separator transported from Stratmat Mine site to the Mill and the initial expense during the first year of operation to transport RoM material over to the Caribou Mill is charged to this category. The total unit operating cost for both mine sites combined is C$13.94. This is summarized in Table 86.

Table 86: General and Administration Operating Cost

Activity	Unit Cost (C$/t)
Administration	$3.88
Water Treatment/Environment	$1.69
Tailings	$1.24
Transport to Stratmat Mill (Halfmile)	$6.78
Environment	$2.01
General Administration (Halfmile)	$0.39
General Administration Total	**$13.94**

20.6.4 Processing Facility Operating Cost

The processing facility is located at Stratmat Mine. The costs include labour, maintenance, power, supplies and services to support the ongoing expense of running the mill. As well as the cost for a Dense Media Seperator (DMS) located on site. All RoM material will be pre-processed through a dense media separator except for year 2020 during that time Halfmile Mine production will be trucked to Caribou mill to process. Allowing the mill to only process 78% of the total tonnes. Capital costs are based on vendor quations for major equipment and operating costs have closely referenced the costs at the Caribou mill.

Mill processing fixed costs is C$4.96/tonne (generally labour). The variable cost to process the RoM material is C$17.95/milled tonne. However, since only 78% of the RoM is processed, this equates to a cost of C$14.10/mined tonne. There is also a cost component to operate the dense media separator (DMS) at C$1.99/mined tonne. Therefore, the total average processing costs is C$21.04/tonne mined.

21 Economic Analysis

This section summarizes the economic analysis completed to support the PEA of the Halfmile-Stratmat integrated project. The Qualified Person taking professional responsibility for this section is Benny Zhang, MEng, PEng (PEO #100115459) of SRK, with inputs from Gary Poxleitner, PMP, PEng (PEO#100015286) of SRK and project cost estimation QP, Ross MacFarlane, PEng (PEO#28062503) of SRK associate and processing QP; Jeffery Barrett, PEng (APEGNB # M6890) of Stantec, environmental and permitting QP; and support from Paul Keller, PEng (PEO#90101775), of Trevali. For depreciation, provincial royalty, and tax calculations, SRK has relied on the expertise of Ms. Anna Ladd, Certified Management Accountant, CFO, of Trevali.

The study team have looked at two scenarios to process the combined mine production from the Halfmile Mine and the Stratmat project: 1) construct a DMS plant and a 3,000 t/d capacity mill at the Stratmat site, the base case scenario; 2) build a DMS plant at the Stratmat site while trucking the DMS product to the existing Caribou mill – the alternative case scenario.

This section presents the base case economic results, while economic results of the alternative case is presented in Section 23 – Other Relavent Data and Information.

21.1 Valuation Methodology

The Halfmile-Stratmat integrated project has been valued using a discounted cash flow (DCF) approach. This method of valuation requires projecting yearly cash inflows, or revenues, and subtracting yearly cash outflows such as operating costs, capital costs, royalties, and provincial and federal taxes. Cash flows are taken to occur at the middle of each period. The resulting net annual cash flows are discounted back to the date of valuation, January 1, 2019, and totalled to determine net present values (NPVs) at the selected discount rates. The internal rate of return (IRR) is calculated as the discount rate that yields a zero NPV. The payback period is calculated as the time needed to recover the initial capital spent from initial investment start.

The results of the economic analysis represent forward-looking information that are subject to a number of known and unknown risks, uncertainties and other factors that may cause actual results to differ materially from those presented here.

This PEA is preliminary in nature. The results of the economic analysis performed as a part of this PEA are based in part on inferred mineral resources. Inferred mineral resources are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the PEA will be realized.

All monetary amounts are presented in Canadian dollars (CAD), unless otherwise specified, and financial results are reported on both post-tax and pre-tax basis.

21.2 Assumptions

The metal prices used in the economic analysis were provided by Trevali. Prices of zinc, lead, copper, and silver are based on consensus average long-term metal prices; price of gold is also based on long-term metal price forecast, but its contribution to the project economics is not counted.

Table 87 shows the key assumptions used in the economic analysis.

Table 87: Assumptions Used in Economic Analysis

Item	Metal Price			Mill Recovery*	Payable**	Off-site Costs
	Unit	In USD	In CAD			
Zn	$/lb	1.15	1.46	85.2%	85%	TC/RC and Deductibles Vary with Smelter Locations, Smelter Terms and Conditions
Pb	$/lb	0.95	1.20	64.7%	95%	
Cu	$/lb	2.72	3.45	40.0%	95%	
Ag in Pb Conc	$/oz	19.00	24.08	58.8%	95%	
Ag in Zn Conc	$/oz	19.00	24.08	20.5%	65%	
Ag in Cu Conc	$/oz	19.00	24.08	1.8%	95%	
Au	$/oz	1283.90	1626.88	0%	0%	
Base Case Discount Rate				8%		
Exchange Rate (US$/C$)				0.79		
Glencore's Royalty on Halfmile project				2%		
Teck's Royalty on Stratmat project				2.5%		
Glencore's Royalty on Stratmat project				2%		
Schedule 1 - NB 2% Royalty				2%		
Schedule 2 - NB 16% Royalty				16%		
Pre-production Investment Credit				10%		
Provincial Income Tax				12%		
Federal Income Tax				15%		

* Provided by Ross MacFarlane, PEng, processing QP.

** Similar project concentrates sold to smelters at normal industry market terms.

21.3 Plant Feed and Concentrate Production

The underground mining schedules were presented in Sections 15.10 to 15.12 of this report and mill feed schedule and concentrate production is shown in Table 88. Life of project mill feed totals 10,219 kt at grades of 6.99% zinc, 2.39% lead, 0.25% copper, 40.70 g/t silver, and 0.36 g/t gold. Plant feed commences in January 2020 and continues for 13 years until December 2032.

Table 88: Life of Mine Plant Feed Schedule and Concentrate Production

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Plant Feed																	
Tonnes of Plant Feed (kt)		320	352	654	845	1093	1092	1092	1092	1092	909	708	617	353			10,219
Zn Grade		5.61%	6.86%	6.48%	7.01%	7.52%	7.78%	7.32%	6.79%	7.03%	6.67%	6.87%	6.53%	6.50%			6.99%
Pb Grade		1.91%	2.54%	2.54%	2.70%	2.78%	2.74%	2.68%	2.52%	2.32%	2.01%	1.94%	1.63%	1.48%			2.39%
Cu Grade		0.37%	0.42%	0.46%	0.27%	0.18%	0.16%	0.16%	0.37%	0.24%	0.30%	0.14%	0.16%	0.18%			0.25%
Ag (g/t)		38.00	50.62	54.44	56.09	49.11	43.99	42.86	38.16	40.15	31.91	27.59	22.04	19.12			40.70
Au (g/t)		0.58	0.56	0.56	0.50	0.44	0.45	0.43	0.33	0.30	0.23	0.13	0.07	0.04			0.36
Metal Mill Recovery																	
Zn Recovery		83.3%	85.1%	84.6%	85.3%	85.7%	85.9%	85.5%	85.0%	85.3%	84.8%	85.1%	84.6%	84.6%			85.2%
Pb Recovery		63.0%	65.3%	65.3%	65.7%	65.8%	65.7%	65.6%	65.3%	64.7%	63.4%	63.1%	61.8%	61.2%			64.7%
Cu Recovery		44.9%	47.1%	48.6%	40.7%	37.2%	36.5%	36.5%	44.9%	39.6%	42.1%	35.7%	36.6%	37.2%			40.0%
Ag Recovery (to Zn Conc)		20.2%	21.7%	22.2%	22.4%	21.5%	20.9%	20.8%	20.2%	20.4%	19.4%	18.9%	18.2%	17.8%			20.5%
Ag Recovery (to Pb Conc)		58.5%	60.0%	60.5%	60.7%	59.8%	59.2%	59.1%	58.5%	58.7%	57.7%	57.2%	56.5%	56.1%			58.8
Ag Recovery (to Cu Conc)		1.7%	2.3%	2.5%	2.5%	2.2%	2.0%	1.9%	1.7%	1.8%	1.4%	1.2%	1.0%	0.9%			1.8
Au Recovery		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			0%
Concentrate Production																	
Zinc Concentrate Grade		**50.00%**	**50.00%**	**50.00%**	**50.00%**	**50.00%**	**50.00%**	**50.00%**	**50.00%**	**50.00%**	**50.00%**	**50.00%**	**50.00%**	**50.00%**			**50.00%**
Ag in Zn Con g/t		83	95	111	106	83	70	72	67	69	55	45	37	31			72
Au in Zn Con g/t																	
Pb in Zn Con %		0.55%	0.90%	0.85%	0.98%	1.08%	1.09%	1.01%	0.88%	0.84%	0.69%	0.68%	0.55%	0.50%			0.88%
Cu in Zn Con %		0.58%	0.67%	0.73%	0.42%	0.28%	0.26%	0.25%	0.59%	0.38%	0.47%	0.22%	0.26%	0.28%			0.39%
Fe in Zn Con %		10.60%	10.60%	10.60%	10.60%	10.60%	10.60%	10.60%	10.60%	10.60%	10.60%	10.60%	10.60%	10.60%			10.60%
Cd in Zn Con %																	
As in Zn Con %																	
Lead Concentrate Grade		**45.00%**	**45.00%**	**45.00%**	**45.00%**	**45.00%**	**45.00%**	**45.00%**	**45.00%**	**45.00%**	**45.00%**	**45.00%**	**45.00%**	**45.00%**			**45.00%**
Zn in Pb Con %		4.17%	6.79%	6.39%	7.38%	8.15%	8.28%	7.63%	6.67%	6.36%	5.21%	5.18%	4.16%	3.75%			6.79%
Cu in Pb Con %		1.67%	1.92%	2.10%	1.21%	0.81%	0.73%	0.72%	1.68%	1.08%	1.36%	0.64%	0.73%	0.80%			1.13%
Ag in Pb con g/t		830	823	895	863	722	652	648	609	705	651	581	554	532			698
Au in Pb con g/t																	
Copper Concentrate Grade		**20.00%**	**20.00%**	**20.00%**	**20.00%**	**20.00%**	**20.00%**	**20.00%**	**20.00%**	**20.00%**	**20.00%**	**20.00%**	**20.00%**	**20.00%**			**20.00%**
Zn in Cu Con %		2.49%	2.86%	3.12%	1.80%	1.20%	1.09%	1.08%	2.50%	1.60%	2.02%	0.95%	1.09%	1.20%			2.02%
Pb in Cu Con %		6.45%	9.09%	9.06%	9.76%	10.09%	9.89%	9.65%	9.01%	8.17%	6.85%	6.55%	5.29%	4.66%			8.50%
Ag in Cu con g/t		79	116	119	262	328	298	285	79	155	73	137	74	50			154
Au in Cu con g/t																	
Zn Concentrate DMT (kt)		29.9	41.1	71.6	101.0	141.0	145.8	136.8	126.0	131.1	102.9	82.7	68.2	38.8			1,217.0
Pb Concentrate DMT (kt)		8.6	13.0	24.1	33.3	44.5	43.6	42.6	40.0	36.5	25.7	19.2	13.9	7.1			352.1
Cu Concentrate DMT (kt)		22.6	3.5	7.4	4.6	3.6	3.2	3.2	9.11	5.1	5.7	1.8	1.8	1.2			52.8

21.4 Cost Estimates

Capital and operating cost estimates are presented in Section 20 of this report. Initial capital is estimated at $230.5 million and sustaining capital is estimated at $187.3 million. Site operating cost is estimated at $91.52/t-milled ($71.88/t-mined).

Capital Costs

A summary of estimated capital costs can be found in Table 78 to Table 79 in Section 20.1.

Operating Costs

A summary of estimated operating costs can be found in Table 84 to Table 86 in Section 20.6 for mining, processing, environmental, and G&A.

Royalties and Taxes Calculation

Royalty and tax payments are calculated according to Canadian Mining Taxation applicable to the province of New Brunswick and specific agreements. For provincial royalty and tax calculations, SRK has relied on the expertise of Ms. Anna Ladd, Certified Management Accountant, CFO, of Trevali. Royalties and taxes applicable to the Halfmile-Stratmat integrated project are presented in Table 87. The current financial model estimates the LoM total value of royalty and tax payments to be $184.2 million, including $48.6 million paying to Teck Resources and Glencore.

Offsite Costs

The base case incorporates the transport charges of US$45 to US$60 per dry tonne of concentrate dependent on concentrate shipping to the assumed smelter destinations.

Other offsite costs include concentrate treatment charges, penalty charges, handling and losses, etc.

21.5 Indicative Economic Results

Base case (a discount rate of 8%) indicative economic results as summarized in Table 89 are favourable for the Halfmile-Stratmat integrated project.

The base case project pre-tax NPV8% is $166 million and the internal rate of return is 23%. The cumulative cash flow value for the project pre-tax is $399 million and the discounted payback period is 3.4 years on initial capital, start from both Stratmat Mine and Mill put into commercial production (2022).

The base case project post-tax NPV8% is $99 million and the internal rate of return is 19%. The cumulative cash flow value for the project post-tax is $263 million and the discounted payback period is 3.6 years on initial capital, start from both Stratmat Mine and mill put into commercial production (2022).

It should be noted that the estimated plant feed is partly based on Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the PEA based on these mineral resources will be realized.

Table 89: Base Case Indicative Economic Results Summary

Items	Units	LoM Total
Revenue		
Gross Revenue from Concentrates	$M	2,285
Offsite Costs	$M	(484)
Net Smelter Return	$M	1,800
Operating Costs		
Mine	$M	(480)
Mill	$M	(274)
Administration	$M	(155)
Environment	$M	(26)
Total Site Operating Cost	$M	(935)
Glencore/Teck Royalties	$M	(48)
EBITDA	**$M**	**817**
Royalties and Taxes		
2% NB Royalty	$M	(27)
16% NB Mining Royalty	$M	(53)
Federal & Provincial Income Taxes	$M	(48)
Total Royalties and Taxes	**$M**	**(136)**
Net Income After NPI	**$M**	**681**
Capital Expenditures		
Halfmile Mobile Equipment	$M	(40)
Halfmile Development	$M	(108)
Halfmile Infrastructure	$M	(30)
Halfmile Mine Closure	$M	(-)
Subtotal Halfmile Capital Expenditures	**$M**	**(178)**
Stratmat Mobile Equipment	$M	(21)
Stratmat Development	$M	(58)
Stratmat Infrastructure	$M	(143)
Stratmat Mine Closure	$M	(18)
Subtotal Stratmat C**apital Expenditures**	**$M**	**(240)**
Total Capital Expenditures	**$M**	**(418)**
Project Net Cash Flow, pre-tax	**$M**	**399**
NPV8%	$M	166
IRR	$M	23%
Payback Period	years	3.4
Project Net Cash Flow, post-tax	**$M**	**263**
NPV8%	$M	99
IRR	$M	19%
Payback Period	years	3.6

21.6 Sensitivity Analysis

The results of the base case sensitivity and other sensitivity analyses are summarized in Table 90 to Table 94, Figure 67 and Figure 68.

Table 90: Post-Tax NPV and IRR Sensitivity Analysis

Variables	Range	Value	Post-Tax NPV (M$)	Post-Tax IRR
Base Case Post Tax NPV and IRR at 8% Discount Rate:			**99**	**19%**
Long-Term Metal Prices (All Metal Prices Vary Together)	20%		252	33%
	10%		177	26%
	0%		**99**	**19%**
	-10%		15	10%
	-20%		(91)	0%
Project Capital Cost (Initial + Sustaining)	20%	502	36	11%
	10%	460	68	15%
	0%	**418**	**99**	**19%**
	-10%	376	130	23%
	-20%	334	161	28%
Project Site Operating Cost ($/t-Milled)	20%	109.8	25	11%
	10%	100.7	62	15%
	0%	**91.5**	**99**	**19%**
	-10%	82.4	135	22%
	-20%	73.2	171	26%
Exchange Rate (US$/C$)	20%	0.95	(27)	5%
	10%	0.87	35	12%
	0%	**0.79**	**99**	**19%**
	-10%	0.71	174	26%
	-20%	0.63	264	35%
Limits	**Max Worse Case**		**(91)**	**0%**
	Max Best Case		**264**	**35%**

Table 91: NPV and IRR Sensitivities to Zinc Price Only

Zn (US$/lb)		**$0.92**	**$1.04**	**$1.15**	**$1.27**	**$1.38**
	100%	**80%**	**90%**	**100%**	**110%**	**120%**
NPV@8% (M$)	99	(22)	43	**99**	151	203
IRR	19%	5%	13%	**19%**	24%	29%

Table 92: NPV and IRR Sensitivities to Lead Price Only

Pb (US$/lb)		**$0.76**	**$0.85**	**$0.95**	**$1.04**	**$1.14**
	100%	**80%**	**90%**	**100%**	**110%**	**120%**
NPV@8% (M$)	99	68	83	**99**	114	130
IRR	19%	15%	17%	**19%**	20%	22%

Table 93: NPV and IRR Sensitivities to Zinc and Lead Prices Varying in Tandem

NPV@8% (M$)			**Zn (US$/lb)**				
			$0.92	**$1.04**	**$1.15**	**$1.27**	**$1.38**
		99	**80%**	**90%**	**100%**	**110%**	**120%**
Pb (US$/lb)	$0.76	80%	(63)	10	68	121	173
	$0.85	90%	(42)	26	84	136	188
	$0.95	100%	(22)	43	**99**	151	203
	$1.04	110%	(2)	58	114	166	217
	$1.14	120%	16	74	129	181	232

Table 94: Post-Tax IRR Sensitivity Analysis with Zinc and Lead Prices Varying in Tandem

IRR			Zn (US$/lb)				
			$0.92	**$1.04**	**$1.15**	**$1.27**	**$1.38**
		19%	**80%**	**90%**	**100%**	**110%**	**120%**
	$0.76	80%	0%	9%	15%	21%	26%
	$0.85	90%	3%	11%	17%	22%	27%
Pb (US$/lb)	$0.95	100%	5%	13%	**19%**	24%	29%
	$1.04	110%	8%	14%	20%	25%	30%
	$1.14	120%	10%	16%	22%	27%	31%

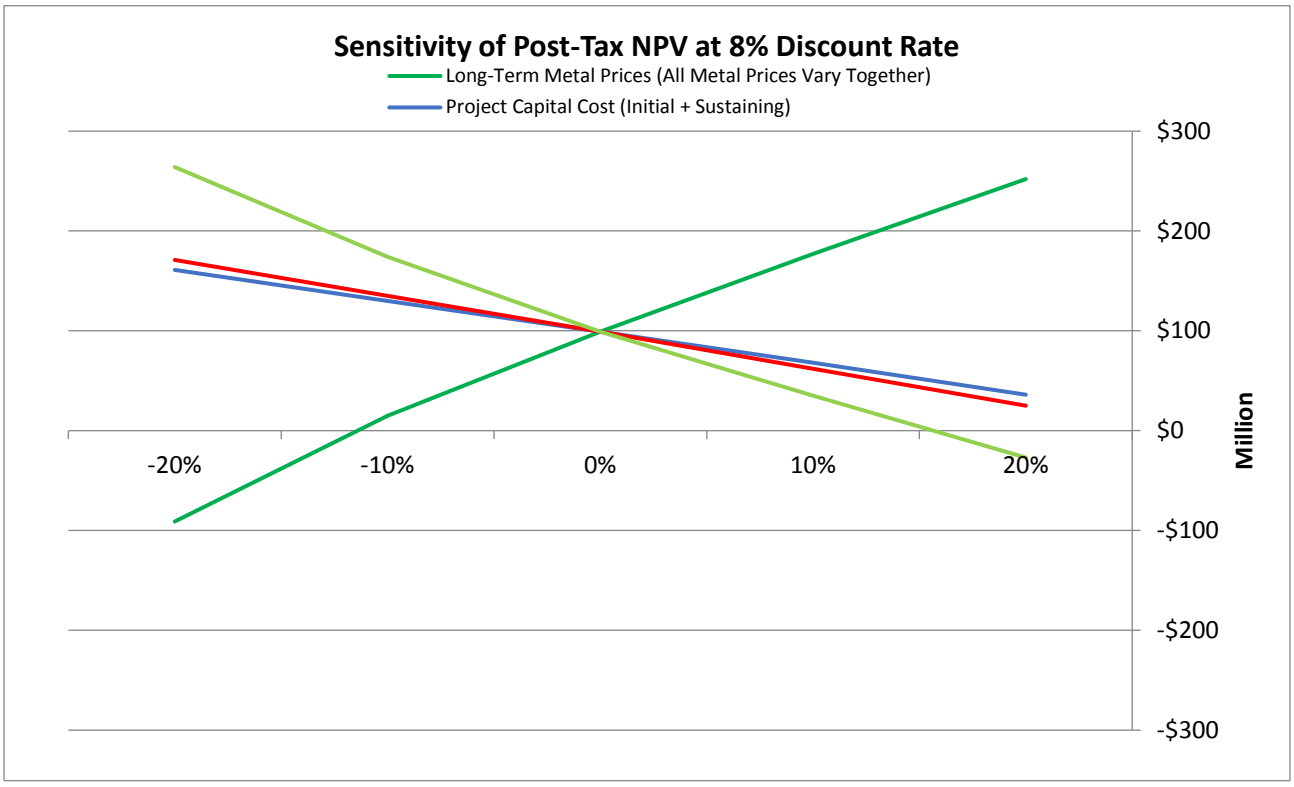


Figure 67: Post-tax NPV8% Sensitivity to Key Input Parameters (Table 90 Dataset)

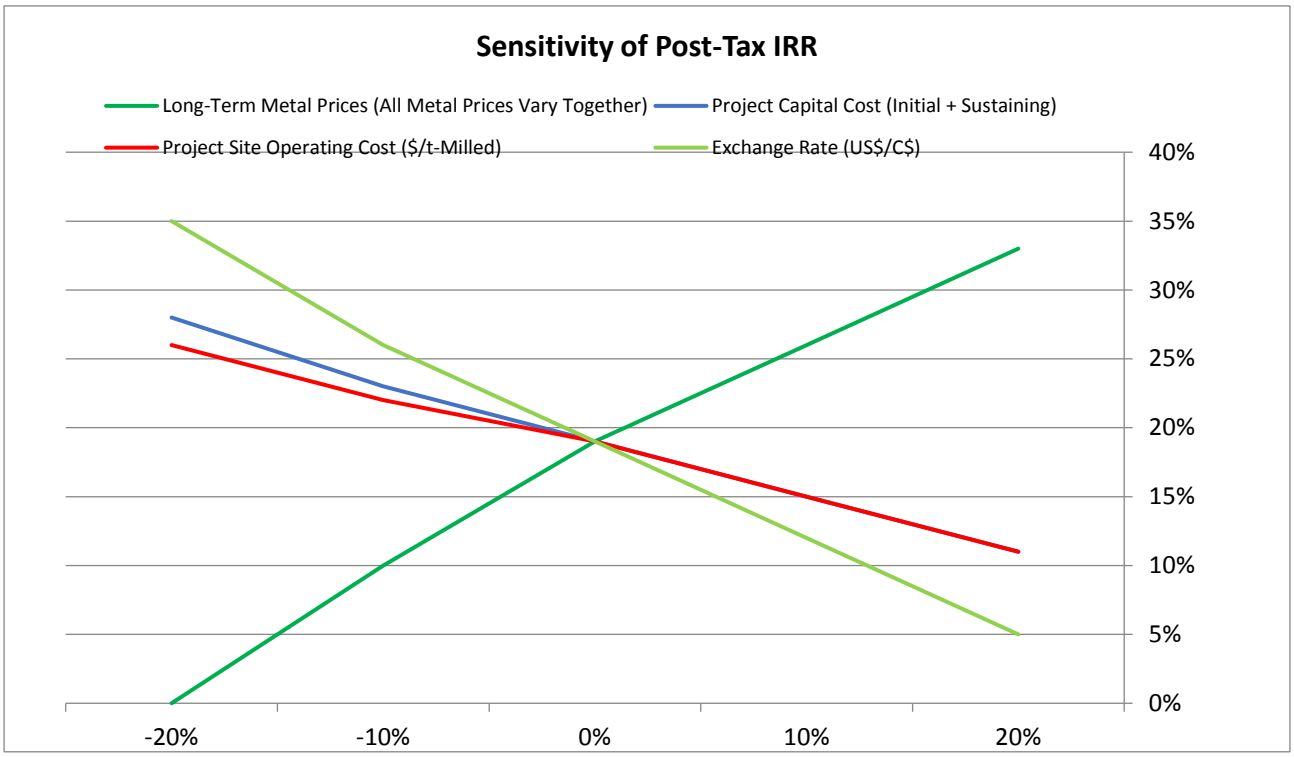


Figure 68: Post-tax IRR Sensitivity to Key Input Parameters (Table 90 Dataset)

Sensitivity analysis was performed on the base case taking into account variations in metal prices, operating cost, capital cost, and exchange rate. As usual with projects of this type, analysis shows that the Halfmile-Stratmat integrated project economic results are most sensitive to changes in metal prices and then exchange rate, because they affect directly the entire revenue stream. The sensitivity analysis shows that the project is less sensitive to operating cost and capital expenditure.

22 Adjacent Properties

The Halfmile-Stratmat integrated project is situated within the BMC. There are some 46 mineral deposits with defined tonnage and another hundred mineral occurrences within a 50-km radius of the property.

There are no significant properties adjacent to the Halfmile project.

Adjacent to the south of the Stratmat project is the former Heath Steele Mine. The Heath Steele mining lease is 100% owned by Xstrata now Glencore and is a VMS lead zinc deposit similar to that of Stratmat.

The Heath Steele Mine deposit was discovered in 1952 by prospectors working for Matthew James Boylen and was the first discovery in Canada of a deposit by means of an airborne EM geophysical survey.

American Metals Climax Inc. (American Metals) had financed Mr. Boylen's exploration and, as a result of a 1953 agreement with (then) International Nickel Company of Canada Ltd. (Inco), acquired a 75% ownership of the new mine. By 1957, a mine and milling operation were established to extract copper, lead and zinc from the ore. Due to low metal prices and metallurgical issues, the mining operation was suspended in April 1958. Mining resumed in June 1962. In 1969, the mine started an ambitious expansion, and by 1979 was producing over 185,000 tonnes of mineral concentrates per year.

As the ore body was gradually depleted, operations were increasingly dependent on strong metal prices. In 1979, Noranda purchased American Metals 75% share in the operation. In April 1983, it was forced to suspend operation due to declining metal prices. In 1986, Noranda purchased all of the remaining interest in the mine. The mine operated sporadically between: 1989−1991; 1992−1993, and; finally, 1994−1999. The underground mine was finally closed and allowed to flood in 1999.

23 Other Relevant Data and Information

23.1 Ownership of North Zone in Halfmile Project

Trevali continues to advance studies on its Halfmile-Stratmat integrated project in order to ascertain if the two deposits can support a second stand-alone milling facility in the BMC separate from the Caribou Mine and mill complex.

Trevali's Halfmile project is a fully permitted underground mining operation that underwent initial trial mining and production in 2012 from the Upper zone of the project. Mineralized material was transported to and toll-processed through the Brunswick 12 mill facility, producing good quality, saleable metal concentrates of zinc, lead-silver and copper-gold. The mill at Brunswick 12 has since been decommissioned and the Brunswick 12 operation has been fully shut down.

Mineral resources for the Halfmile project include resources for the Upper, Lower, Deep, South and North zones. While the mineral resources are reported as 100% being owned by Trevali, the North zone is only 61.5% controlled by Trevali. Table 95 summarizes the North zone mineral resources at 100% and at 61.5% to demonstrate the impact on the partial ownership by Trevali.

It should be noted that the North zone is **excluded** from the current Halfmile project PEA mine plan.

SRK is unaware of any other relevant information pertaining to the Halfmile-Stratmat integrated project.

Table 95: Effect of 61.5% Partial Ownership of North Zone

Class	100% Ownership Tonnes	61.5% Ownership Tonnes	Grade				
			Zn (%)	Pb (%)	Cu (%)	Au (g/t)	Ag (g/t)
Indicated	613,000	377,000	6.19	1.28	0.35	0.07	5
Inferred	23,000	14,000	5.20	1.58	0.17	0.08	3

23.2 General Description of Alternative Processing Case – Modified Caribou Mill to Process DMS Product

The Caribou mill currently operating on the Caribou Mine production is scheduled to end operations in 2021 according to the 2016 LoM. This mill capacity has potential to process the mineralization from the Halfmile-Stratmat integrated project. While the general flowsheet requirements for differential flotation of lead, zinc and copper for the Stratmat and Halfmile style of mineraliztion is similar to Caribou requirements, the metal liberation point is considerably coarser than required for Caribou. The initial grinding requirement for Stratmat and Halfmile prior to flotation requires 80 % passing 72 microns versus the much finer requirement of Caribou at 80% passing 30 microns. This reduced power requirement in primary grinding will make the rheology of the slurry flow throughout the flowsheet much coarser and somewhat increase the power requirements for agitation and pipeline velocities throughout the circuit to keep the particles in suspension. Some retrofit of the Caribou mill will be required to achieve the anticipated results from the Stratmat and Halfmile testwork. The scope of the retrofit is described below. It is assumed that the predicted metallurgy on the Stratmat and Halfmile plant feed can be achieved with minimal retrofit of the current Caribou flowsheet.

The Caribou Mill employs conventional flotation technology that has been developed since the 1960s to process the finely disseminated zinc/lead/copper mineralization found in the Bathurst Camp. The recovery of the metals from the Halfmile and Stratmat mineralization will employ these conventional technologies in crushing and grinding operations to liberate the minerals with flotation used to concentrate the metals to saleable concentrates. The grinding and flotation sections of the existing Caribou Mill will require some retrofitting to process the Stratmat and Halfmile mineralization.

Primary and secondary crushing will be used to allow a DMS plant to reject barren material from the plus 3 mm size from the mill feed effectively increasing the mill head grade and reducing the overall operating costs. The primary crushing before the DMS plant will reduce the mineralization to 100% passing 65 mm, refers to Section 16.2.1.

The existing Caribou SAG Ball mill grinding circuit will be used to grind the Stratmat-Halfmile plant feed prior to flotation concentration of the metals. The existing Isamills at Caribou will be used for regrinding within the flotation circuit and eliminates the use of steel media and the associated difficulties in subsequent flotation operations.

The Caribou Mill will be retrofited to provide a nameplate capacity of 3,000 tonnes per day of plant feed. At this production, the annual throughput capability will be 1.09 million tonnes assuming operating at 93% of the time for 350 days per year. This capacity will be in line with the requirements of the Halfmile-Stratmat integrated project which is based on 4,000 tpd of RoM material of which 22 % would be rejected in the DMS plant reducing the Caribou capacity necessary to 3,120 tpd at peak time.

23.3 Project Cost Estimate of the Alternative Case

23.3.1 Alternative Case Capital Cost Summary

The alternative case total pre-production capital costs for Halfmile Mine and Stratmat Mine are estimated at C$155.6. The alternative case project total capital costs are estimated at C$332.1 million ($M), including pre-production capital expenditures and sustaining capital expenditures.

This includes capital lease payments of mobile equipment, capital purchases of surface and underground infrastructure, capital development and for mine closure bonds. This is summarized in Table 96. All costs are in Canadian dollars ($C) and inclusive of a 25% contingency. The cost components are discussed further in the following sections of this report.

Table 96: Alternative Case Pre-Production Capital Expenditure

Description	Units	Halfmile	Stratmat	Combined
Mobile Equipment	$M	17.8	1.1	18.9
Capital Development	$M	31.5	25.1	56.6
Infrastructure	$M	24.5	51.0*	75.5
Mine Closure	$M	2.3	2.4	4.6
Total	**$M**	**76.1**	**79.5**	**155.6**

* Include Caribou Mill Complex modification cost

The ongoing, sustaining total capital costs for the remaining life of the combined Halfmile and Stratmat Mine complex life (following the pre-production period) is estimated at C$176.5M. This includes ongoing capital leasing of mobile equipment, ongoing rebuilds and improvements on surface and underground infrastructure, and ongoing capital development. This is summarized in Table 97. All costs are in Canadian dollars ($C) no contingency was applied to sustaining costs.

Capital costs were sourced from third party equipment manufacturers, contractors and vendors, SRK's internal capital database and from Trevali company personnel. The capital estimation was completed with an accuracy of +40%/-30%.

It should be noted that the alternative case total capital expenditure savings versus the case case discussed in Section 20.1 are mainly contributed in two areas – mill complex inclusing tailings storage facilities, and tailings storage facilities closure cost.

Table 97: Alternative Case Sustaining Capital Expenditure

Description	Units	Halfmile	Stratmat	Combined
Mobile Equipment	$M	21.7	19.7	41.5
Capital Development	$M	76.4	33.2	109.6
Infrastructure	$M	5.8	8.5	13.6
Mine Closure	$M	-	11.8	11.8
Total	**$M**	**103.9**	**73.3**	**176.5**

* Closure cost of the Caribou mill complex and tailings storage facilities have been expenses in the existing mill operations.

** Mine closure costs are both sites, not separate by site.

23.3.2 Alternative Case Operating Cost Summary

For both underground mines, Halfmile and Stratmat, an operating cost model utilizing a factoring methodology was developed. This was completed by utilizing Trevali's Caribou Mine as the bases of estimation. In some cases, where mine activities were not available from Caribou Mine, cost were then based on SRK's database of benchmarked data, with similar activities as that of the proposed mines. The benchmarked unit costs were then factored (increased up or down) to reflect Halfmile and Stratmat mines operation. A fixed and variable component was included thus allowing the costs to reflect the production rate of each particular year.

Operating costs include labour, supplies, services, power and mobile equipment maintenance and parts. The average operating cost for mining per tonne mined for Halfmile Underground is estimated at $38.24/tonne and for Stratmat Underground at $33.44/t. The General and Administration costs for integrated project is estimated at $16.13/tonne and a processing costs of $20.26/tonne. These costs are summarized in Table 98. The total operating cost are estimated at $73.22/t-mined.

Table 98: Halfmile and Stratmat Mine and Mill Complex Operating Cost Summary

Area	Unit Cost ($/t mined)
Stratmat Underground Mine (at site)	33.44
Halfmile - Underground Mine (at site)	38.24
Stratmat/Halfmile - G & A	16.13
Stratmat/Halfmile - Processing Cost	20.26
Total	**73.22**

23.4 Alternative Case Indicative Economic Results

Alternative case scenario (a discount rate of 8%) indicative economic results as summarized in Table 99 are more favourable for the Halfmile-Stratmat integrated project than the base case scenario.

Table 99: Alternative Case Indicative Economic Results Summary

Items	Units	LoM Total
Revenue		
Gross Revenue from Concentrates	$M	2,285
Offsite Costs	$M	(484)
Net Smelter Return	$M	1,801
Operating Costs		
Mine	$M	(482)
Mill (incl. DMS)	$M	(264)
Administration	$M	(184)
Environment	$M	(26)
Total Site Operating Cost	$M	(956)
Glencore/Teck Royalties	$M	(48)
EBITDA	**$M**	**796**
Royalties and Taxes		
2% NB Royalty	$M	(29)
16% NB Mining Royalty	$M	(75)
Federal & Provincial Income Taxes	$M	(101)
Total Royalties and Taxes	**$M**	**(204)**
Net Income After NPI	**$M**	**592**
Capital Expenditures		
Halfmile Mobile Equipment	$M	(40)
Halfmile Development	$M	(108)
Halfmile Infrastructure	$M	(30)
Halfmile Mine Closure	$M	(2)
Subtotal Halfmile Capital Expenditures	**$M**	**(179)**
Stratmat Mobile Equipment	$M	(21)
Stratmat Development	$M	(58)
Stratmat Infrastructure & Caribou Mill Complex Modifications	$M	(59)
Stratmat Mine Closure	$M	(14)
Subtotal Stratmat C**apital Expenditures**	**$M**	**(153)**
Total Capital Expenditures	**$M**	**(332)**
Project Net Cash Flow, pre-tax	**$M**	**464**
NPV8%	$M	222
IRR	$M	34%
Payback Period	years	2.6
Project Net Cash Flow, post-tax	**$M**	**260**
NPV8%	$M	116
IRR	$M	25%
Payback Period	years	2.9

The alternative base case project pre-tax NPV8% is $222 million and the internal rate of return is 34%. The cumulative cash flow value for the project pre-tax is $464 million and the discounted payback period is 2.6 years on initial capital, start from both Stratmat Mine and DMS put into commercial production (2022).

The alternative case project post-tax NPV8% is $116 million and the internal rate of return is 25%. The cumulative cash flow value for the project post-tax is $260 million and the discounted payback period is 2.9 years on initial capital, start from both Stratmat Mine and DMS put into commercial production (2022).

It should be noted that the estimated plant feed is partly based on Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the PEA based on these mineral resources will be realized.

24 Interpretation and Conclusions

The Halfmile-Stratmat integrated project is an advanced stage lead-zinc deposit, located in eastern Canada. It is located 45 km southwest of Bathurst, New Brunswick. The Project contains two significant base metal deposits, the Halfmile and Stratmat projecst. Trevali Mining Corporation (Trevali) owns a 100% interest, subject to royalty interest in the project through the acquisition of Kria Resources. The property is accessible via Highway 480, then by a gravel road that branch off the Highway.

This report is based on information collected by SRK during several site visits performed between November 2014 and November 2016 for the Stratmat and Halfmile projects and on additional information provided by Trevali throughout the course of SRK's investigations. Other information was obtained from the public domain. SRK has no reason to doubt the reliability of the information provided by Trevali.

24.1 Geology and Resource Estimate

The Halfmile-Stratmat integrated project is situated within the Bathurst Mining Camp (BMC) which occupies a roughly circular area of approximately 70 km diameter in the Miramichi Highlands of northern New Brunswick. The area boasts some 46 mineral deposits with defined tonnage and another hundred mineral occurrences, all hosted by Cambro-Ordovician rocks that were deposited in an ensialic back-arc basin.

Mineralization within the Halfmile project is found within five separate lenses and the Stratmat project is composed of six discrete lenses. The sulphide minerals at both deposits consist of disseminated and massive sphalerite-galena-pyrite and chalcopyrite. The sulphide minerals are fine to medium-grained, and are coarser than those typically found in deposits of the Bathurst-Newcastle district.

Block model quantities and grade estimates for the Halfmile and Stratmat projects were classified according to the CIM Definition Standards for Mineral Resources and Mineral Reserves (December 2014) by Dr. Gilles Arseneau, PGeo. An appropriate "independent qualified persons" as this term is defined in National Instrument 43-101.

SRK is satisfied that the geological modelling honours the current geological information and knowledge. The location of the samples and the assay data are sufficiently reliable to support resource evaluation. The sampling information was acquired primarily by diamond drilling on sections spaced at 30 m.

The selection of the search radii and rotations of search ellipsoids were guided by the geometry of the estimation domains and the modelled ranges of continuity from variograms. In addition, the search radii were established to estimate a large portion of the blocks within the modelled area with limited extrapolation. The parameters were refined by conducting repeated test resource estimates and reviewing the results as a series of plan views and sections.

Each block was interpolated with at least three composites representing at least two drill holes. A maximum of 12 composites were used to estimate any given block.

Mineral resources were considered for the Indicated category where blocks are estimated by at least three drill holes from a minimum of seven samples from the first interpolation pass for the Halfmile Lade deposit and by at least three composite samples from a minimum of two drill holes from the first interpolation pass for the Stratmat project. All remaining estimated blocks within the estimation domains are classified as Inferred. A small portion of the Indicated mineralization was upgraded to Measured near the area of test mining in the Upper zone of the Halfmile project.

Based on the above parameters, SRK estimate that at a 5% Zinc equivalent cut-off, the Halfmile project contains 7.8 million tonnes in the Measured and Indicated categories grading 6.94% zinc, 2.35% lead, 0.18% copper, 36 g/t silver and 0.3 g/t gold. In addition, there are also 6.5 million tonnes classified as Inferred mineral resources grading 5.62% zinc, 1.51% lead, 0.15% copper, 23 g/t silver and 0.1 g/t gold contained within the Halfmile project.

The Stratmat project contains 4.7 million tonnes grading 5.3% zinc, 2.13% lead, 0.4% copper, 49 g/t silver and 0.6 g/t gold in the Indicated category and an additional 2.4 million tonnes grading 4.8% zinc, 2.1% lead, 0.7% copper, 39 g/t silver and 0.4 g/t gold in the Inferred category.

24.2 Mining

This PEA was prepared by a group of independent consultants supported by Trevali to demonstrate the economic viability of an integrated project including two mines and an existing mill complex, targeting all mineral resources defined in the Halfmile project and Stratmat project. This technical report provides a summary of the results and findings from each major area of investigation to a level that is considered to be consistent with that normally expected for a PEA of a resource development project.

The results of the PEA indicate that the integrated project including re-opening of the proposed Halfmile Mine and newly constructed Stratmat Mine and Stratmat DMS has financial merit at the base case assumptions considered. The results are considered sufficiently reliable to guide Trevali's management in a decision to advance the project to a prefeasibility study.

Analysis of the results of the investigations has identified a series of risks and opportunities associated with each of the technical aspects considered for the development of the proposed project.

The key risks include:

- Approximately 34% by tonnage or 32% by NSR value of the plant feed is from Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the PEA based on these mineral resources will be realized.
- There is a risk of increased external dilution beyond the planned amount. This would reduce the mill head grade and have a negative impact on revenue.
- There is a risk that the predictive metallurgy associated with DMS and/or mill will not be consistently achieved with a negative impact on the revenue.
- A process related risk at present is the ability to recruit suitably trained staff for a relatively difficult plant feed to process; however as noted skilled labour from Trevali Caribou operations and a skilled labour pool from the local communities is available.
- The Halfmile Mine site is a fully permitted facility that allows for mining under the existing certificate of approval, while the Stratmat Mine and mill sites will need different permits, any delay of the prerequisite permits will negatively affect the project start time and PEA economic results.

The key opportunities include:

- Exploration potential to increase the mineral resources of the Halfmile and Stratmat projects with additional drilling targeting the deep extension below the currently defined mineralization zones for both properties, and Stratmat S1 Shallow zone.
- Further stope design optimization will lead to reduced internal dilution and increased plant feed head grades.
- Further detailed mine planning work could possibly bring more mineralized material into the mine plan.
- Further definition drilling should convert some of the existing Inferred mineral resources to Indicated or Measured category. This will be a benefit for future higher level technical studies.
- There is a potential to improve the predicted metallurgical forecast for the Stratmat plant feed through additional metallurgy test work and optimization of the plant flow sheet.
- There is potential to use different technology to construct a preconcentration plant to reject more of waste with lower metal losess to increase the mill feed head grade and improve project economics. Alternative preconcentration test work by Trevali is currently on-going.
- There is a potential to bring Halfmile North zone mineralization into the future mine plan and improve the project economics. Trevali owns 61.5% interest of the North zone. To simplify the current PEA, SRK was instructed by Trevali to exclude the North zone in the PEA mine plan.

24.3 Metallurgy and Processing

The PEA base case is based on construction of a new concentrator at the Stratmat site to process both the Stratmat mineralization and the Halfmile mineralization which will be trucked to the Stratmat site. The new concentrator will have a capacity of 3,000 t/d and employ conventional differential flotation technology to produce three saleable metal concentrates of zinc, lead, and copper. For both the metallurgical performance and the operating costs of a new concentrator, reference has been made to the current operations of Trevali operation at the nearby Caribou Mine.

The design of the Stratmat concentrator flowsheet is based on metallurgical testwork that has been completed initially on Stratmat mineralization in 1998 by Noranda with short term test milling of the deposit in 2012 at the Brunswick commercial large scale flotation mill. In 2015 and 2016-2017 bench scale metallurgical work was completed on a combined sample of Stratmat and Halfmile to establish the main processing parameters of the mineralization.

Preliminary testwork was also carried out on a mining sample of Halfmile to investigate the potential benefits of applying dense media separation on the RoM materials to reject barren materials before the concentrator. Metallurgical parameters ae derived from the testwork for the flowsheet design, and the anticipated mill recoveries from the operation are 85.3% for zinc, 65.0% for lead, 40.1% for copper, 58.8% for silver in lead concentrate, 20.5% silver in zinc concentrate, and 1.8% silver in copper concentrate.

As experienced with other Bathurst style of mineralization, the Stratmat and Halfmile sample showed the requirement of relatively finer grinding to liberate the minerals, but significantly less than the requirement for the existing Caribou plant feed. The new Stratmat concentrator will initially grind the mill feed material to a P_{80} of 72 microns with the application of Isamills for regrinding within the flotation circuit which will help control contamination with iron grinding media within the flotation concentration stages.

The Stratmat concentrator will have a DMS circuit integrated into the concentrator flowsheet to reject barren rock from the RoM material prior to primary grinding. The preliminary testwork has indicated that a 22% weight rejection could be achieved and this material will be used as backfill in the mining operations.

The capital cost of the 3,000 t/d concentrator is estimated at $86.6 million and the dense media separation plant is estimated at $12.5 million, including 25% contingency. The operating cost of the concentrator is estimated to be $21.04/t-mined or $26.79/t-milled including DMS operating cost.

24.4 Environmental

The Halfmile Mine site is a fully permitted facility that allows for the operation of the underground mine and associated surface infrastructure under the existing CofA.

A reclamation plan for the Halfmile Mine site is currently on file with the Government of New Brunswick and was submitted October 6, 2010.

The proposed Stratmat Mine, DMS plant, concentrator, and TMF are not currently permitted and will be subject to the NB EIA Regulation and may also be subject to the federal EA process.

A reclamation plan for the proposed Stratmat Mine site will be filed with the Government of New Brunswick prior to the commencement of construction activities.

The key environmental risks include:

- Regulatory decisions, outcomes, or timelines associated with the completion of the permitting processes are not in the control of the proponent, and the requirements are highly subject to regulatory discretion, external influence (e.g., public intervention), and other factors.
- A federal EA may have to be completed if there are real or perceived concerns.

The key opportunities include:

- Baseline environmental and engineering assessments should be initiated as soon as possible in order to complement the existing database for Stratmat as this may help in accelerating the permitting process.

25 Recommendations

25.1 Geology

SRK recommends that Trevali continues exploring the Halfmile-Stratmat integrated project. More specifically, SRK recommends that Trevali carry out initial metallurgical testing of the Stratmat mineralized zones to determine their recoverability. SRK also recommends that Trevali undertake a drilling program to better define the mineralization at both projects.

At the Halfmile project, Trevali should target an additional 10 drill holes to better define irregularities in the geological model of the Lower zone.

At the Stratmat project, Trevali should target an additional 10 drill holes on the S1 Shallow zone to better define the geological continuity of this narrow mineralization and drill 8 to 10 holes on the S1 Deep zone to better identify mineralization in the north limb of this zone.

Overall SRK estimates that the cost of the combined phases of work is expected to cost $1.2 million as outlined in Table 100.

SRK is unaware of any other significant factors and risks that may affect access, title, or the right or ability to perform the exploration work recommended for the Stratmat project.

Table 100: Estimated Cost for the Exploration Program Proposed for the Stratmat Project

Item	Cost ('000)
Phase 1	
Metallurgical and DMS testing	$500
Sub Total Phase 1	**$500**
Phase 2	
Drilling of Lower zone Halfmile (4500 m)	$362
Drilling S1 Deep north limb Stratmat (3000 m)	$242
Drilling S1 Shallow Stratmat (2500 m)	$201
Geological support	$96
Assay costs	$22
Technical support	$44
Mineral resource update	$70
Sub Total Phase 2	**$1,037**
Total Phase 1 and 2	**$1,537**

25.2 Metallurgical Testing

SRK recommends that metallurgical testwork continue with development of all the process parameters that are necessary for detailed design of all the unit operations of the concentrator including the thickening and filtration characteristics of the concentrates and tailings. This should also include full characterization of the concentrates and tailings for marketing and environmental requirements.

Future process testwork should select samples from each deposit that are representative of the mineralization as well as any dilution that will be included as a result of mining operations. This

should include both hanging-wall and footwall material as well as any gangue inclusions that may enter the RoM mineralization. Mineralogical analysis of any of this material that may impact the mill operation such as talc minerals should be identified.

Developing technology with the design of flotation cells (i.e. staged float cells) should be investigated for possible application in the flowsheet and the expected benefits. Supplier testwork may be required.

Estimated costof $200,000 will be needed.

25.3 DMS Testing

An industry review for the best practices in the application of DMS should be carried out and if still positive a testwork program on a combined RoM material sample of Stratmat and Halfmile should be designed to make the final decision for inclusion in the Stratmat concentrator.

The estimated cost is $300,000.

25.4 Mining

- Perform a prefeasibility level of Stratmat geotechnical study to support next stage of Stratmat design .
- An estimated $120,000 cost will be needed.
- Perform a prefeasibility level of Stratmat Mine hydrogeological study to support next stage of Stratmat Mine dewatering design. An estimated $60,000 cost will be needed.
- Perform a prefeasibility level of Halfmile Lower zone and Deep zone geotechnical study to support next stage of Halfmile Mine deign. An estimated $80,000 cost will be needed.
- Perform a prefeasibility level of Halfmile Mine hydrogeological study to support next stage of Halfmile Mine dewatering design. An estimated $50,000 cost will be needed.
- Evaluate Halfmile Mine primary access options between ramp and shaft for the extraction of Lower zone and Deep zone mineralization. A more comprehensive trade-off study will be needed.

25.5 Environmental and Permitting

Engineering and Planning studies should commence in early to mid-2017 for the environmental infrastructure and design as follows:

- Site Geotechnical Investigation to assess infrastructure foundations and borrow sources
- Hydrogeological studies including water balance, surface and groundwater models
- Detailed testing of waste rock for acid generating potential
- Environmental Assessment
- Alternatives Assessment for TMF should be completed
- Approvals to operate for Halfmile should be updated and reviewed regularly
- Approval to operate should be obtained for Stratmat and reviewed regularly
- Stratmat should be registered under EIA and MMER regulations

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APPENDIX A

Mineral Tenure Information
Cox & Palmer Title Opinion

COX & PALMER | coxandpalmerlaw.com

New Brunswick | Newfoundland and Labrador | Nova Scotia | Prince Edward Island

May 30, 2014

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Brookfield Place
181 Bay Street, Suite 1800
Toronto, ON M5J 2T9

Blake, Cassels & Graydon LLP
199 Bay Street, Suite 4000, Commerce Court West
Toronto, ON M5L 1A9

Computershare Trust Company of Canada,
as Trustee and Agent (as such terms are defined below)
510 Burrard St.
Vancouver, BC V6C 3A8

GMP Securities L.P.
145 King Street West, Suite 300
Toronto, ON M5H 1J8

Dear Sirs / Mesdames:

Re: **Trevali Mining Corporation, Trevali Renewable Energy Inc., Trevali Mining (Maritimes) Ltd. and Trevali Mining (New Brunswick) Ltd.**
Our File No. 2140998

A. Introduction

We have acted as local counsel in the Province of New Brunswick to Trevali Mining Corporation (the "**Issuer**"), Trevali Renewable Energy Inc. ("**Trevali Renewable**") Trevali Mining (Maritimes) Ltd. ("**Trevali Maritimes**") and Trevali Mining (New Brunswick) Ltd. ("**Trevali NB**") (Trevali NB together with the Issuer, Trevali Renewable and Trevali Maritimes collectively the "**Transaction Parties**") in connection with a note indenture dated as of the 30th day of May, 2014 (the "**Indenture**") among the Issuer and Computershare Trust Company of Canada, as trustee (the "Trustee") and as Collateral Agent (the "**Agent**"), and to provide a legal opinion with respect to, among other things,

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the registration and perfection of a general security agreement dated May 30th, 2014 made by the Transaction Parties in favor of the Agent (the "**Security Agreement**") and the Debenture (as defined below) and with respect to title to the following:

1. Mining Lease No. ML-246, held in the name of Trevali NB;
2. Halfmile Lake Mining Lease 261, held in the name of Trevali Maritimes;

(hereinafter collectively referred to as the "**Mining Leases**")

3. Halfmile Lake Central Mineral Claim No. 1681, held in the name of Trevali Maritimes;
4. Woodside Brook Mineral Claim No. 1773, held in the name of the Trevali NB;
5. Stratmat Mineral Claim No. 6049, held in the name of Trevali Maritimes;

(hereinafter collectively referred to as the "**Active Claims**")

6. Halfmile Lake North-Mattagami Mineral Claim No. 1850, held in the name of Trevali Maritimes;
7. Halfmile Lake South Mineral Claim No. 1900, held in the name of Trevali Maritimes;

(hereinafter collectively referred to as the "**Inactive Claims**")

(the Active Claims and the Inactive Claims are hereinafter collectively referred to as the "**Claims**")

8. Industrial Surface Lease No. SIML2271 (also referred to as Crown Lands Lease #415060027 and hereinafter referred as the "**Surface Lease**") over the lands identified as PID 50237924 (the "**Leasehold Lands**") held in the name of Trevali NB; and

9. The freehold lands identified as PID 50072032 (hereinafter referred to as the "**Freehold Lands**"), held in the name of the Trevali NB.

The Claims are more particularly described in Schedule "A" hereto.

B. <u>Scope of Review</u>

For the purposes of this opinion letter, we have examined executed copies of the following documents:

1. The Mining Leases and the Surface Lease (collectively the "**Title Documents**");

2. The Indenture (which is governed by the laws of Ontario);

3. A non-disturbance agreement dated as of May 30th, 2014 among Trevali NB, the Agent and Her Majesty the Queen in Right of the Province of New Brunswick, as represented by the Minister of Natural Resources (the "**Non-Disturbance Agreement**");

4. A debenture dated May 30th, 2014 issued by Trevali Maritimes and Trevali NB to the Agent (the "**Debenture**");

5. The Security Agreement (which is governed by the laws of Ontario); and

6. A guarantee dated May 30th, 2014 made by Trevali NB in favor of the Trustee (which is governed by the laws of Ontario) (the "**Guarantee**").

We have also examined and relied upon for the purposes of this opinion letter, executed copies of: (a) a Certificate of an Officer of Trevali NB dated May 30th, 2014 attaching (i) Trevali NB's articles of incorporation and by-laws, and (ii) resolutions of the board of directors of Trevali NB with respect to the Documents (as hereinafter defined), as to certain matters of fact set out therein, and (b) share certificate no. Com-1 representing 100 common shares in the capital of Trevali NB on which the Issuer is recorded as the registered owner thereof, together with a transfer power of attorney for such share certificate endorsed in blank by the Issuer. The securities evidenced by such certificate are collectively referred to as the "**Pledged Shares**".

The Security Agreement and the Debenture are hereinafter collectively referred to as the "**Security Documents**" and the Security Documents, the Guarantee, the Indenture and the Non-Disturbance Agreement are hereinafter collectively referred to as the "**Documents**".

For the purposes of this opinion we have also examined copies of certificates of public authorities, corporate records and other documents and materials as more particularly described in Schedule "B", and have made such investigations and considered such questions of law, as we have determined are relevant and necessary or appropriate as a basis for providing this opinion.

C. <u>Assumptions and Reliance</u>

For purposes of our opinions expressed herein, we have, with your consent, assumed and relied upon the following:

1. with respect to all documents examined by us, the genuineness of all signatures, the legal capacity of individuals signing any documents, the authenticity of all documents submitted to us as originals and the conformity to authentic original documents of all documents submitted to us as certified, confirmed, telecopied or photocopied copies; and

2. the accuracy, currency and completeness of the indices and filing systems maintained by the public offices and registries where we have searched or enquired or have caused searches or enquiries to be made.

D. Laws Addressed

We are solicitors qualified to practice law in the Province of New Brunswick. We express no opinion as to the laws of any jurisdiction, or as to any matters governed by the laws of any jurisdiction, other than the laws of the Province of New Brunswick and the laws of Canada applicable therein in effect on the date hereof (collectively, "**Applicable Law**").

E. Opinions

Based upon and relying upon the foregoing and subject to the assumptions and qualifications hereinbefore and hereinafter set forth, we are of the opinion that:

1. The authorized share capital of Trevali NB consists of an unlimited number of common shares. The Issuer is registered as the holder of the Pledged Shares, which are all of the issued and outstanding shares in the capital stock of Trevali NB as of the date of this opinion. The Pledged Shares have been duly and validily authorized and issued as fully paid and non-assessable.

2. Trevali NB has all necessary corporate power and capacity to own its properties and assets, to conduct its business as now carried on by it and to enter into and to perform its obligations under each of the Documents to which it is a party.

3. Trevali NB is a corporation incorporated and validly existing under the laws of the Province of New Brunswick.It has not been dissolved under the laws of the Province of New Brunswick as of the date of the Certificate of Corporate Status listed in Schedule "B", and it is in good standing with respect to its annual report filings with the New Brunswick Corporate Affairs Registry.

4. As of the date of the Certificate of Corporate Status listed in Schedule "B", Trevali Maritimes is a corporation extra-provincially registered and in good standing under the laws of the Province of New Brunswick and that it is in good standing, with respect to its annual report filings with the New Brunswick Corporate Affairs Registry.

5. The execution and delivery of the Documents by Trevali NB, and the performance of its obligations thereunder, have been duly authorized by all necessary corporate action on the part of Trevali NB.

6. Each of the Documents to which Trevali NB is a party have been duly executed and delivered by Trevali NB.

7. The Debenture constitutes a legal, valid and binding obligation of, and is enforceable in accordance with its terms against Trevali Maritimes and Trevali NB.

8. The Non-Disturbance Agreement constitutes a legal, valid and binding obligation of, and is enforceable in accordance with its terms against Trevali NB.

9. All necessary corporate action has been taken by Trevali NB and its shareholder to authorize the transfer of the Pledged Shares to the Agent or its nominee (including the registration on the share register of Trevali NB of the transfer of the Pledged Shares to the Agent or its nominee) and any subsequent transfer of the Pledged Shares by the Agent or its nominee in connection with the realization thereof, and copies of all such consents, approvals or authorizations have been provided to the Agent.

10. The authorization, execution, delivery and performance by Trevali NB of the Documents to which it is a party do not and will not contravene or result in a breach of or constitute a default under (i) the articles of incorporation, the by-laws or any unanimous shareholders' agreement, if applicable, of Trevali NB, (ii) any statute or regulation of the Province of New Brunswick or the laws of Canada applicable therein binding on or applicable to Trevali NB; (iii) any resolutions of the board of directors of Trevali NB (or any committee thereof) or its shareholders contained in its minute books; or (iv) any judgment, order or decree of any court or administrative tribunal applicable to Trevali NB.

11. The authorization, execution, delivery and performance by each of the Issuer, Trevali Renewable, and Trevali Maritimes of the Documents, to the extent a party thereto, do not and will not contravene or result in a breach of or constitute a default under any statute or regulation of the Province of New Brunswick or the laws of Canada applicable in the Province of New Brunswick binding on or applicable to such party.

12. There are no: (a) authorizations, consents, permits or approvals required of, or other actions (collectively, "**Authorizations**") required by; (b) filings required to be made with; or (c) notices required to be given to, any governmental agency or authority, regulatory body, court, tribunal or other similar entity having jurisdiction under Applicable Law in connection with the execution and delivery by the Issuer, Trevali NB, Trevali Renewable, or Trevali Maritimes, of each of the Documents to which it is a party, or the performance by the Issuer, Trevali NB, Trevali Renewable, or Trevali Maritimes, of their respective obligations thereunder, other than registration of the Debenture under the applicable Land Titles and Registry System in New Brunswick, recording the Debenture under the Mining Act and the filing of financing statements under the Personal Property Security Act of New Brunswick (the "**PPSA**") and such other Authorizations as have been obtained prior to the date hereof.

13. Subject to the qualification set out in paragraph 1 of part F hereof, the Debenture creates a valid mortgage, charge and security interest in favour of the Agent in the Freehold Lands as well as the Leasehold Lands (collectively the "**Real Properties**") and the Mining Leases (collectively the "**Charged Real Properties**") to secure payment and performance of the obligations described therein as being secured thereby.

- 6 -

14. The Security Agreement creates a valid security interest in favour of the Agent in the Collateral (as defined in the Security Agreement) that is personal property (collectively the "**Charged Personal Property**" and together with the Charged Real Properties, the "**Charged Property**") in which any of the Transaction Parties now has rights, and is sufficient to create a valid security interest in favour of the Agent in the Charged Personal Property in which any of the Transaction Parties hereafter acquires rights, in each case to secure payment and performance of the obligations described therein as being secured thereby.

15. Registration has been made in all public offices provided for under the laws of the Province of New Brunswick or the federal laws of Canada applicable therein where such registration is necessary or desirable to preserve, protect or perfect the security interests created by each of the Security Documents in favour of the Agent in the Charged Property. The details of all such registrations are set out in Schedule "C". Except as provided in Schedule "C", no renewal or amendment of any such filing, registration or recording is required.

16. We have conducted, or have caused to be conducted, the searches identified in Schedule "B" attached hereto (the "**Searches**") for filings and registrations made in the applicable offices of public record, in each case as of the dates and limited in scope as set forth in Schedule "B". Based upon the Searches, the only encumbrances against the Charged Property ranking in priority to the liens and charges of the Debenture and the Security Agreement are set forth in Schedule "B".

17. Trevali NB is the holder on record of the Active Mineral Claim identified as Woodside Brook and more particularly described in Schedule "A" hereto and has good title thereto subject only to the registrations listed in Schedule "B", the Qualifications listed herein and the Permitted Liens (as defined in the Indenture);

18. Trevali Maritimes is the holder on record of the Active Claims identified as Halfmile Lake Central and Stratmat, as well as the Inactive Claims (which have been subsumed into Mining Lease 261), all of which are more particularly described in Schedule "A" hereto and has good title thereto subject only to the registrations listed in Schedule "B", the Qualifications listed herein and the Permitted Liens (as defined in the Indenture);

19. The Active Claims expire on the following dates, respectively, unless otherwise renewed:

    Halfmile Lake Central Mineral Claim No. 1681 expires November 18th, 2014;

    Woodside Brook Mineral Claim No. 1773 expires June 15th, 2014; and

    Stratmat Mineral Claim No. 6049 expires July 27th, 2014;

20. The Active Claims are in good standing until their respective expiry dates;

21. Trevali NB is the holder or lessee on record of Mining Lease No. ML-246 and the Surface Lease and has good title thereto subject only to the registrations listed in Schedule "B", the Qualifications listed herein and the Permitted Liens (as defined in the Indenture);

22. Trevali Maritimes is the holder or lessee of record of Mining Lease 261 and has good title thereto subject only to the registrations listed in Schedule "B", the Qualifications listed herein and the Permitted Liens (as defined in the Indenture);

23. The Mining Leases and the Surface Lease are in good standing;

24. Trevali NB is the registered owner of the Freehold Lands and has good and marketable title thereto, in fee simple, and is the registered Lessee of the Leasehold Land and has good leasehold title thereto, in each case, subject only to the registrations listed in Schedule "B" attached hereto and the Qualifications listed herein.

F. Qualifications

Our opinions are also subject to the following qualifications:

1. With respect to the opinions set out in paragraph 13 of part E hereof, the Ministerial Consent with respect to the mortgage, charge and security interest of the Debenture in the Surface Lease and the Ministerial Consent with respect to the mortgage, charge and security interest of the Debenture in the Mining Leases, have not been issued as of the date hereof. Accordingly, to the extent that such Ministerial Consents are required to make such mortgage, charge and security interest valid and effective, such mortgage, charge and security interest will not be valid or effective until such time that such Ministerial Consents are issued.

2. The existence of any intervening rights of any party having an interest in the Mining Leases and the Claims that is not discoverable on a search of the public registries and subject to applicable bankruptcy and insolvency legislation or similar laws affecting the rights of creditors generally.

3. We express no opinion concerning potential aboriginal title or interests, whether by treaty or otherwise, in and to in the Mining Leases and the Claims and express no view or opinion upon the duty of a claim holder or lease holder to consult with aboriginal peoples with respect to the exploration for or extraction of natural resources.

4. We have undertaken no investigation of the manner in which the Mining Leases and the Claims were staked, recorded or otherwise claimed, the actual boundaries of the Mining Leases and the Claims and have restricted our opinions and investigations to those documents in the hands of the Recorder of Mines under the *Mining Act* (New Brunswick)(the "**Recorder**").

5. We have relied upon the accuracy and completeness of the records maintained by the Recorder, including abstracts and indices prepared by the Recorder. We would however caution you that such records and indices suffer from inherent weaknesses. Unrecorded but delivered instruments may affect title to the Mining Leases and the Claims. Unrecorded instruments may give rise to the assertion of interests in the Mining Leases and Claims by parties unknown to us and undiscoverable by a search of the records.

6. Our opinions are further predicated solely upon the laws that exist as of the date hereof as they currently apply and to the facts in existence as of the date hereof and we assume no obligation to revise or supplement this opinion in the event of any changes to the present laws either by legislative action, judicial decision or for any reason whatsoever.

7. We have not undertaken any physical inspection of the lands or premises to which the Claims, the Mining Leases, the Surface Lease, or the Freehold Lands pertains.

8. We have not conducted searches of title of the landlord (Natural Resources & Energy) as pertains to the Surface Lease.

9. We have not examined any certificates or reports pertaining to environmental matters affecting the Freehold Lands or the Leasehold Lands.

10. All rights, duties or obligations arising under any of the Title Documents must be exercised and discharged in good faith and in a commercially reasonable manner.

11. Insofar as our opinions relate to mortgages, pledges, charges or assignments, such opinions are subject to any liens, charges, adverse claims, mortgages, assignments, security interests or encumbrances perfected otherwise than by currently effective and publicly available registrations.

12. Trevali NB's title to the Freehold Lands is subject to the following:

    a. any subsisting exceptions, reservations, covenants and conditions in favour of the Crown contained in or implied by grant of the land from the Crown or excepted or reserved by statute, including any standing trees and timber vested in the Crown;

    b. the right of a lessee under a subsisting lease or agreement for a lease for a period not exceeding three years where there is actual occupation of the land under the lease or agreement;

    c. any rights which may have been acquired by prescription or adverse possession (squatters rights) in respect of the real property or any part thereof.

13. Pursuant to the *Land Titles Act*, Trevali NB's title to the Freehold Lands is also subject to the following:

Land Titles Act

17 (4) Unless the contrary is expressly declared in the title register, all registered land is, by implication and without any special mention in the title register, subject to the following overriding incidents:

(a) any subsisting exceptions, reservations, covenants and conditions in favour of the Crown contained in or implied by grant of the land from the Crown or excepted or reserved by statute, including any standing trees and timber vested in the Crown;
(b) the right of a lessee under a subsisting lease or agreement for a lease for a period not exceeding three years where there is actual occupation of the land under the lease or agreement;
(c) any right of a spouse of the registered owner to occupy the land under the *Marital Property Act*;
(d) any right granted by or under an enactment of Canada or the Province
(i) to enter, go across or do things on land for the purpose specified in the enactment,
(ii) to recover taxes, duties, charges, rates or assessments by proceedings in respect of land,
(iii) to expropriate land,
(iv) to restrict the use of land, or
(v) to control, regulate or restrict the subdivision of land;
(e) any lien under the *Mechanics' Lien Act* where the time within which the claim of lien is required to be filed has not expired.

14. The validity and the binding nature of the Security Documents and the rights and remedies created by them are subject to the powers of a court to grant relief from forfeiture, to stay proceedings before it and to stay executions on judgments.

15. Without derogating from our opinion as to the status of the Mining Leases, Claims and Surface Lease or the effectiveness of the security interests therein created by the Security Documents, the validity and the binding nature of the Security Documents and the rights and remedies created by them are subject to the rights and privileges of the Crown in right of Canada or any Province of Canada and its agents and the terms of statutes or regulations governing the assignability of Crown debts.

16. We express no opinion as to the creation, validity or perfection of a security interest in any property in respect of which there is applicable federal legislation which is paramount over provincial legislation relating to security interests in personal property, including copyrights, trademarks, patents and industrial designs.

17. Our opinions are not to be taken as relating to any tangible property or assets while the same are located outside the Province of New Brunswick, or as to the validity of any security interests created by the Security Documents insofar as they relate to any such property.

18. No opinion is expressed as to the validity and binding nature of the provisions of the Security Documents purporting to waive applicability or effect of applicable laws including, without limitation, laws relating to notice.

19. No opinion is expressed with respect to the Security Documents, as to the perfection of any security interest in any collateral to which the PPSA does not apply other than the Real Properties, the Mining Leases and the Claims.

20. No opinion is expressed as to perfection of any security interest in any personal property to which the security interest has not "attached" within the meaning of the PPSA, including without limitation collateral in which the subject borrower has yet to acquire rights.

21. If the personal property charged under the Security Documents or any proceeds thereof now or hereafter includes an interest or claim in or under any contract of annuity or policy of insurance, no opinion is expressed herein as to the creation, validity or perfection of the security interest therein other than in respect of the transfer of a right to money or other value payable under a policy of insurance as indemnity or compensation for loss of or damage to property or the proceeds thereof.

22. The security interests, charges and pledges expressed to be created by the Security Documents may not be effective in respect of any collateral not described with sufficient particularity therein.

23. Advances made, if any, to the subject debtor, by the subject lender, after an intervening charge in favour of a judgement creditor may rank subject to the rights of such judgment creditor pursuant to subsection 35(6) of the PPSA.

24. To the extent that the security interests created under the Security Documents:

    (i) attach an Intangible;

    (ii) attach Goods which are of a type that are normally used in more than one jurisdiction, if such Goods are classified as Equipment or Inventory which are leased or held for lease to others by the relevant borrower; or

    (iii) is a non-possessory security interest in a Security, Chattel Paper, a negotiable Document of Title, an Instrument or Money;

the validity, perfection and effect of perfection or non-perfection of the security interest is governed by the laws of the jurisdiction in which the relevant grantor's place of business is located

or, in the event it has more than one place of business, at its chief executive office at the time at which the security interest attaches (capitalized words in this paragraph have the meaning prescribed thereto in the PPSA).

25. If the collateral mortgaged and charged under the Security Documents or any proceeds thereof include goods which become affixed to real property other than the Real Properties a notice will be required to be filed in the appropriate land registry office in the Province of New Brunswick.

26. We have not verified the existence of any personal property described in the Security Agreement.

G. Reliance

This opinion is for the benefit of, and may be relied upon only by, the addressees hereto and their respective permitted successors, assigns and participants for the purposes of the transaction addressed herein and may not be relied upon by any other Person for any other purpose, nor may it be quoted in whole or in part or otherwise referred to, without our prior written consent.

Yours very truly,

George L. Cooper

GLC/

- 12 -

SCHEUDLE "A"

Description of Active Claims and Inactive Claims

NB e-CLAIMS

Page 1 of 1

Search

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Client List

Please select from the list of owners matching the criteria to continue the search.

15777	TREVALI MINING (NEW BRUNSWICK) LTD.	Mineral Claims	View Client Details
15492	TREVALI MINING (MARITIMES) LTD.	Mineral Claims	View Client Details

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n al Claim Detail

Right Number 1773
Claim Type Mineral
Claim Sub Type Claim
Title Type Mineral Exploration Agreement
Expiry Date 2014-06-15
Issue Date 1988-06-15
Claim Name Woodside Brook
Status Active
NTS Sheet 21 O/09
Owners 15777 TREVALI MINING (NEW BRUNSWICK) LTD. 100%

Claim Events:

Submitter	Event	Effective Date
Joe Macintosh	Tenure Protection Removal --4683	2011-06-15
15764	Renewal --4684	2011-06-15
15784	Renewal --4685	2011-06-15
15824	Renewal --10041	2012-06-01
15804	Renewal --15086	2013-05-27

Number of Units 38
Work Applied $499,778.99
Work Required $428,500.00
Excess Work $71 278.97

Units:

Unit Id	Expiry Date	Total Applied	Work Required	Excess Work
1321003I	2014-06-15	$3 075 76	$1 200 00	$1,875.76
1321003J	2014-06-15	$3,075 76	$1,200 00	$1,875.76
1321003K	2014-06-15	$3,075 76	$1,200 00	$1,875.76
1321003L	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321003M	2014-06-15	$3,075 76	$1,200.00	$1,875.76
1321003N	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321003O	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321003P	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321004A	2014-06-15	$3,075.76	$1 200 00	$1,875.76
1321004B	2014-06-15	$3,075 76	$1,200 00	$1,875.76
1321004C	2014-06-15	$3,075 76	$1,200.00	$1,875 76
1321004D	2014-06-15	$3,075.76	$1,200 00	$1,875.76
1321004E	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321004F	2014-06-15	$3,075 76	$1,200.00	$1,875.76
1321004G	2014-06-15	$3,075 76	$1,200.00	$1,875 76
1321004H	2014-06-15	$3,075.76	$1,200.00	$1,875 76
1321004I	2014-06-15	$3,075.76	$1,200.00	$1,875 76
1321004J	2014-06-15	$3,075.76	$1,200.00	$1,875 76
1321004K	2014-06-15	$3,075 76	$1,200 00	$1,875.76
1321004L	2014-06-15	$3,075.76	$1,200 00	$1,875 76
1321004N	2014-06-15	$3,075.76	$1,200.00	$1,875 76
1321004O	2014-06-15	$3,075 76	$1,200 00	$1,875 76
1321005B	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321013I	2014-06-15	$3,075 76	$1,200.00	$1,875.76
1321013J	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321013K	2014-06-15	$3,075 76	$1,200.00	$1,875.76
1321013L	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321013M	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321013N	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321013O	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321013P	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321014A	2014-06-15	$3,075.76	$1,200.00	$1,875.76

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Unit Id	Expiry Date	Total Applied	Work Required	Excess Work
1321014B	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321014C	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321014D	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321014G	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321014H	2014-06-15	$3,075.76	$1,200.00	$1,875.76
1321014I	2014-06-15	$3,075.76	$1,200.00	$1,875.76

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Search Criteria

Search Criteria	Prospecting Licence Number
	15482

Mineral Claim List

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A total of 4 mineral claims were found

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Right Number	Mineral Claim Name	Right Holder	Mineral Claim Type	Mineral Claim Sub Type	NTS Sheet	Original Effective Date	Expiry Date	Status
1681	Halfmile Lake Central	15482 100%	Mineral	Claim	21 O/06	1983-11-18	2014-11-18	Active
1850	Halfmile Lake North-Mattagami	15482 100%	Mineral	Claim		1984-11-08	2012-11-08	Inactive
1900	Halfmile Lake South	15482 100%	Mineral	Claim		1985-01-04	2013-01-04	Inactive
6049	Stratmat	15482 100%	Mineral	Claim	21 O/06	1983-07-27	2014-07-27	Active

A total of 4 mineral claims were found

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neral Claim Detail

Right Number 1681
Claim Type Mineral
Claim Sub Type Claim
Title Type Mineral Exploration Agreement
Expiry Date 2014-11-18
Issue Date 1983-11-18
Claim Name Halfmile Lake Central
Status Active
NTS Sheet 21 O/06
Owners 15492 TREVALI MINING (MARITIMES) LTD. 100%

Claim Events:

Submitter	Event	Effective Date
15674	Renewal —2697	2010-11-09
15674	Transfer of Ownership (Initiation) —4954	2011-07-14
15792	Transfer of Ownership (Completion) —4959	2011-07-14
15804	Report of Work —5892	2011-10-24
15804	Renewal —5896	2011-10-24
15804	Grouping —9855	2012-05-17
15804	Report of Work —10581	2012-07-04
15804	Renewal — 10583	2012-07-04
15804	Renewal —16922	2013-10-26

Number of Units 59
Work Applied $1,305,618.00
Work Required $983,100.00
Excess Work $322,518.00

Units:

Unit Id	Expiry Date	Total Applied	Work Required	Excess Work
1421021B	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521019D	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521019E	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521019K	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521019L	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521019M	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521019N	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521019O	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521020B	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521020C	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521020D	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521020E	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521020F	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521020K	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521020L	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521028L	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521028M	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521028N	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521028O	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521028P	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521029A	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521029B	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521029C	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521029H	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521029I	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521029P	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521030A	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521030E	2014-11-18	$11,378.27	$1,600.00	$9,778.27

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Unit Id	Expiry Date	Total Applied	Work Required	Excess Work
1521030F	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521030G	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521030H	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521030I	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521030J	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521030K	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521030N	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521030O	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521030P	2014-11-18	$6,723.73	$1,600.00	$5,123.73
1521038I	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521038J	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521038K	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521038N	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521038O	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521038P	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521039B	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521039C	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521039E	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521039F	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521039G	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521039J	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521039K	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521039L	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521039M	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521039N	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521039O	2014-11-18	$11,378.27	$1,600.00	$9,778.27
1521040B	2014-11-18	$11,378.27	$1,600.00	$9,778.27
1521040C	2014-11-18	$11,378.27	$1,600.00	$9,778.27
1521040H	2014-11-18	$11,378.27	$1,600.00	$9,778.27
1521049I	2014-11-18	$6,628.27	$1,600.00	$5,028.27
1521049P	2014-11-18	$6,628.27	$1,600.00	$5,028.27

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neral Claim Detail

Right Number 1850
Claim Type Mineral
Claim Sub Type Claim
Title Type Mineral Exploration Agreement
Expiry Date 2012-11-08
Issue Date 1984-11-08
Claim Name Halfmile Lake North-Mattagami
Status Inactive
NTS Sheet
Owners 15492 TREVALI MINING (MARITIMES) LTD. 100%

Claim Events:

Submitter	Event	Effective Date
15674	Renewal ---2576	2010-10-29
15674	Transfer of Ownership (Initiation) ---4953	2011-07-14
15769	Transfer of Ownership (Completion) ---4958	2011-07-14
15804	Report of Work ---5891	2011-10-24
15804	Renewal ---5893	2011-10-24
15804	Grouping ---9655	2012-05-17

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neral C n Detail

Right Number 1900
Claim Type Mineral
Claim Sub Type Claim
Title Type Mineral Exploration Agreement
Expiry Date 2013-01-04
Issue Date 1985-01-04
Claim Name Halfmile Lake South
Status Inactive
NTS Sheet
Owners 15492 TREVALI MINING (MARITIMES) LTD. 100%

Claim Events:

Submitter	Event	Effective Date
15674	Renewal —3067	2010-12-15
15674	Transfer of Ownership (Initiation) —4955	2011-07-14
15789	Transfer of Ownership (Completion) —4960	2011-07-14
15804	Report of Work —5894	2011-10-24
15804	Renewal — 5895	2011-10-24
15804	Grouping — 9855	2012-05-17

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Ineral Claim Detail

Right Number 6049
Claim Type Mineral
Claim Sub Type Claim
Title Type Mineral Exploration Agreement
Expiry Date 2014-07-27
Issue Date 1983-07-27
Claim Name Stratmat
Status Active
NTS Sheet 21 O/08
Owners 15492 TREVALI MINING (MARITIMES) LTD. 100%

Claim Events:

Submitter	Event	Effective Date
15789	Transfer of Ownership (Completion) --- 4961	2011-07-14
15804	Report of Work --- 5897	2011-10-24
15804	Renewal --- 5948	2011-10-27
15804	Renewal --- 15443	2013-06-26

Number of Units 95
Work Applied $1,437,403.73
Work Required $792,983.00
Excess Work $646,838.73

Units:

Unit id	Expiry Date	Total Applied	Work Required	Excess Work
1422021D	2014-07-27	$7,645.21	$800.00	$6,845.21
1422021E	2014-07-27	$7,645.21	$800.00	$6,845.21
1422031A	2014-07-27	$7,645.21	$800.00	$6,845.21
1422031B	2014-07-27	$7,645.21	$800.00	$6,845.21
1422031C	2014-07-27	$7,645.21	$800.00	$6,845.21
1422031D	2014-07-27	$7,645.21	$800.00	$6,845.21
1422031E	2014-07-27	$7,645.21	$800.00	$6,845.21
1422031F	2014-07-27	$7,645.21	$800.00	$6,845.21
1422031G	2014-07-27	$7,645.21	$800.00	$6,845.21
1422031H	2014-07-27	$7,645.21	$800.00	$6,845.21
1422031I	2014-07-27	$7,645.21	$800.00	$6,845.21
1422031J	2014-07-27	$7,645.21	$800.00	$6,845.21
1422041A	2014-07-27	$7,645.21	$800.00	$6,845.21
1422041B	2014-07-27	$7,645.21	$800.00	$6,845.21
1522030D	2014-07-27	$7,069.19	$800.00	$6,269.19
1522030E	2014-07-27	$7,645.21	$800.00	$6,845.21
1522030F	2014-07-27	$7,645.21	$800.00	$6,845.21
1522030K	2014-07-27	$7,645.21	$800.00	$6,845.21
1522030L	2014-07-27	$7,645.21	$800.00	$6,845.21
1522030M	2014-07-27	$7,645.21	$800.00	$6,845.21
1522030N	2014-07-27	$7,645.21	$800.00	$6,845.21
1522039M	2014-07-27	$7,069.19	$800.00	$6,269.19
1522040B	2014-07-27	$7,069.19	$800.00	$6,269.19
1522040C	2014-07-27	$7,645.21	$800.00	$6,845.21
1522040D	2014-07-27	$7,645.21	$800.00	$6,845.21
1522040E	2014-07-27	$7,645.21	$800.00	$6,845.21
1522040F	2014-07-27	$7,645.21	$800.00	$6,845.21
1522040G	2014-07-27	$7,645.21	$800.00	$6,845.21
1522040H	2014-07-27	$7,645.21	$800.00	$6,845.21
1522040I	2014-07-27	$7,645.21	$800.00	$6,845.21
1522040J	2014-07-27	$7,645.21	$800.00	$6,845.21
1522040K	2014-07-27	$7,645.21	$800.00	$6,845.21
1522040L	2014-07-27	$7,645.21	$800.00	$6,845.21

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Unit Id	Expiry Date	Total Applied	Work Required	Excess Work
1522040M	2014-07-27	$7,645.21	$800.00	$6,845.21
1522040N	2014-07-27	$7,645.21	$800.00	$6,845.21
1522040O	2014-07-27	$7,645.21	$800.00	$6,845.21
1522040P	2014-07-27	$7,645.21	$800.00	$6,845.21
1522049K	2014-07-27	$7,069.19	$800.00	$6,269.19
1522049L	2014-07-27	$7,645.21	$800.00	$6,845.21
1522049M	2014-07-27	$7,645.21	$800.00	$6,845.21
1522049N	2014-07-27	$7,645.21	$800.00	$6,845.21
1522049O	2014-07-27	$7,645.21	$800.00	$6,845.21
1522049P	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050A	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050B	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050C	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050D	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050E	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050F	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050G	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050H	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050I	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050J	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050K	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050L	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050M	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050N	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050O	2014-07-27	$7,645.21	$800.00	$6,845.21
1522050P	2014-07-27	$7,645.21	$800.00	$6,845.21
1522059C	2014-07-27	$7,069.19	$800.00	$6,269.19
1522059D	2014-07-27	$7,645.21	$800.00	$6,845.21
1522059E	2014-07-27	$7,645.21	$800.00	$6,845.21
1522059F	2014-07-27	$7,645.21	$800.00	$6,845.21
1522059J	2014-07-27	$7,069.19	$800.00	$6,269.19
1522059K	2014-07-27	$7,645.21	$800.00	$6,845.21
1522059L	2014-07-27	$7,645.21	$800.00	$6,845.21
1522059M	2014-07-27	$7,645.21	$800.00	$6,845.21
1522059N	2014-07-27	$7,645.21	$800.00	$6,845.21
1522059O	2014-07-27	$7,645.21	$800.00	$6,845.21
1522059P	2014-07-27	$7,645.21	$800.00	$6,845.21
1522060A	2014-07-27	$7,645.21	$800.00	$6,845.21
1522060B	2014-07-27	$7,645.21	$800.00	$6,845.21
1522060C	2014-07-27	$7,645.21	$800.00	$6,845.21
1522060D	2014-07-27	$7,645.21	$800.00	$6,845.21
1522060E	2014-07-27	$7,645.21	$800.00	$6,845.21
1522060F	2014-07-27	$7,645.21	$800.00	$6,845.21
1522060G	2014-07-27	$7,645.21	$800.00	$6,845.21
1522060H	2014-07-27	$7,645.21	$800.00	$6,845.21
1522060I	2014-07-27	$7,645.21	$800.00	$6,845.21
1522060J	2014-07-27	$7,645.21	$800.00	$6,845.21
1522068O	2014-07-27	$7,645.21	$800.00	$6,845.21
1522068P	2014-07-27	$7,645.21	$800.00	$6,845.21
1522069A	2014-07-27	$7,645.21	$800.00	$6,845.21
1522069B	2014-07-27	$7,645.21	$800.00	$6,845.21
1522069C	2014-07-27	$7,645.21	$800.00	$6,845.21
1522069F	2014-07-27	$7,645.21	$800.00	$6,845.21
1522069G	2014-07-27	$7,645.21	$800.00	$6,845.21
1522069H	2014-07-27	$7,645.21	$800.00	$6,845.21
1522069I	2014-07-27	$7,645.21	$800.00	$6,845.21
1522069J	2014-07-27	$7,645.21	$800.00	$6,845.21
1522069K	2014-07-27	$7,645.21	$800.00	$6,845.21
1522069N	2014-07-27	$7,645.21	$800.00	$6,845.21
1522069O	2014-07-27	$7,645.21	$800.00	$6,845.21
1522069P	2014-07-27	$7,645.21	$800.00	$6,845.21
1522070A	2014-07-27	$7,645.21	$800.00	$6,845.21

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SCHEDULE "B"

Enquiries and Searches Conducted and Results thereof

	Search Performed	Name/PID Searched	Date of Results	Results
1.	Real Property Tax Certificate	1. 50237924/PAN 4899231 2. 50072032/PAN 3383229	May 5/14 May 5/14	$977.91 (unpaid) May 31st is due date. $124,487.94 (unpaid) May 31st is due date
2.	Water & Sewer LIP	1. 50237924 2. 50072032	May 8/14	Verbal confirmation from Bathurst municipality - PIDs not serviced
3.	Sales Tax Status	Trevali Mining (New Brunswick) Ltd. Maple Minerals Corporation Trevali Mining (Maritimes) Ltd.	May 8/14 May 8/14 May 8/14	Not Registered Not Registered Not Registered
~~4.~~	~~Sheriff Certificate~~			
5.	Corporate Affairs (Cert. of Status)	Trevali Mining (New Brunswick) Ltd. Maple Minerals Corporation Trevali Mining (Maritimes) Ltd.	May 5/14 May 5/14 May 5/14	In good standing until December, 2014 Does not exist (amalgamated – last annual return filed 2011) In good standing until February, 2015
6.	Notice of Intention to give Bank Act Security	Trevali Mining (New Brunswick) Ltd. Maple Minerals	May 2/14 May 2/14	No results. No results.

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		Corporation Trevali Mining (Maritimes) Ltd.	 May 2/14	 No results.
7.	Bankruptcy	Trevali Mining (New Brunswick) Ltd. Maple Minerals Corporation Trevali Mining (Maritimes) Ltd.	May 2/14 May 2/14 May 2/14	No results. No results. No results.
8.	PPSA	Trevali Mining (New Brunswick) Ltd. Maple Minerals Corporation Trevali Mining (Maritimes) Ltd.	May 17/14 May 5/14 May17/14	Registration No. 22878649 dated 2013-04-22 in favor of RMB Resources Limited and RMB Australia Holdings Limited against "All present and after-acquired personal property of the Debtor" Registration No. 24385502 dated 2014-05-16 in favor of Computershare Trust Company of Canada against "All of the Debtor's present and after-acquired personal property" Registration No. 20626701 dated 2011-09-27 in favor of Honda Canada Finance – Motor Vehicle Registration No. 22878607 dated 2013-04-22 in favor of RMB Resources Limited and

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				RMB Australia Holdings Limited against "All present and after-acquired personal property of the Debtor" Registration No. 24385494 dated 2014-05-16 in favor of Computershare Trust Company of Canada against "All of the Debtor's present and after-acquired personal property"
9.	Zoning	1. 50237924 2. 50072032	May 9/14 May 9/14	LSD no Zoning LSD no Zoning
10.	Worker's Compensation	Trevali Mining (New Brunswick) Ltd. Maple Minerals Corporation Trevali Mining (Maritimes) Ltd.	May 5/14 May 5/14 May 5/14	Not registered. Not registered. Registered – in good standing for 2014
11.	Labour Standards	Trevali Mining (New Brunswick) Ltd. Maple Minerals Corporation Trevali Mining (Maritimes) Ltd.	May 5/14 May 5/14 May 5/14	No results. No results. No results.
12.	Bylaw Infraction	1. 50237924 2. 50072032	May 9/14 May 9/14	LSD no Zoning LSD no Zoning
13.	Employment Standards Legislation	Trevali Mining (New Brunswick) Ltd.	May 5/14	Active Investigation

		Maple Minerals Corporation Trevali Mining (Maritimes) Ltd.	May 5/14	No results. Active Investigation
14.	Grantor Search (5 Years)	Trevali Mining (New Brunswick) Ltd. Maple Minerals Corporation Trevali Mining (Maritimes) Ltd.	May 5/14 May 5/14 May 5/14	Debenture #32606890 registered on 2013-04-26 against PID #50237924 in favour of RMB Resources Limited & RMB Australia Holdings Limited No results. Debenture #32606890 registered on 2013-04-26 against PID #50237924 in favour of RMB Resources Limited & RMB Australia Holdings Limited
15.	Environmental Search	1. 50237924 2. 50072032	May 7, 2014	2. Petroleum storage tank information received from Department of Environment and history of associated source contamination.
16.	~~Employer Remittances CRA~~	~~Trevali Mining (New Brunswick) Ltd.~~ ~~Maple Minerals Corporation~~ ~~Trevali Mining (Maritimes) Ltd.~~		

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17.	Real Property (order CRO)	1. ~~50237924~~ (not Land Titles) 2. 50072032	Not requested	1. Not on land titles – see below for search results ** 2. Debenture in favor of RMB Australia Holdings Limited and RMB Resources Limited registered April 26th, 2013 as document no. 32607179
18.	Litigation Search	Trevali Mining (New Brunswick) Ltd. Maple Minerals Corporation Trevali Mining (Maritimes) Ltd.	May 6/14 May 6/14 May 6/14	No results. FC-146-2012 – Margaret Kent/Ross Burns/MMC Holding/Maxim Finskiy/Francis Scola No results.
19.	Human Rights Complaints	Trevali Mining (New Brunswick) Ltd. Maple Minerals Corporation Trevali Mining (Maritimes) Ltd.	May 5/14 May 5/14	No results. No results.
20.	Mining Leases and Claims	1. Mining Lease No. ML-246; 2. Halfmile Lake Mining Lease 261 3. Industrial Surface Lease No. SIML2271 (also	1., 2.,4.,5.,6.Recorder of Mines May 12, 2014 3. Dept. Of Natural Resources	1. renewed to October 27th, 2028 and annual rent paid to October 27th, 2014 2. issued to December 12, 2031 and annual rent paid to December 12, 2014 3. in good standing; 2014 rental paid in full. Site inspection conducted in 2012 showed physical

		referred to as Crown Lands Lease #415060027) 4. Halfmile Lake Central Mineral Claim No. 1681; 5. Woodside Brook Mineral Claim No. 1773; 6. Stratmat Mineral Claim No. 6049;	May 6, 2014	site was in conformance with departmental terms and conditions per lease agreement. 4. renewed to November 18, 2014 5. renewed to June 15, 2014 6. renewed to July 27th, 2014
21.	an electronic search of the NB e-CLAIMS electronic mineral claims registry maintained by the Office of the Recorder under the *Mining Act* (New Brunswick) (the "NB e-Claims Registry").	1. Halfmile Lake Central Mineral Claim No. 1681; 2. Woodside Brook Mineral Claim No. 1773; 3. Stratmat Mineral Claim No. 6049; 4. Halfmile Lake North-Mattagami Mineral Claim No. 1850; 5. Halfmile Lake South Mineral	May 5/14	1. Active 2. Active and subject to 10% Net Profits Interest held by the Fern Trust, see note below *** 3. Active 4. Inactive 5. Inactive

		Claim No. 1900;		
22.	The contents of the files maintained by the Recorder of Mines under the *Mining Act* (New Brunswick)	1. Mining Lease No. ML-246; 2. Halfmile Lake Mining Lease 261 3. Halfmile Lake Central Mineral Claim No. 1681; 4. Woodside Brook Mineral Claim No. 1773; 5. Stratmat Mineral Claim No. 6049;	As of May 6, 2014 at 9:30 a.m.	Each is subject to a Debenture in favor of RMB Australia Holdings Limited and RMB Resources Limited filed with the Recorder of Mines under the Mining Act (New Brunswick) as of April 26th, 2013 1. In good standing; held by Trevali NB see note *** below 2. In good standing; held by Trevali Maritimes; 3. In good standing; held by Trevali Maritimes; presently renewed until November 18th, 2014 4. In good standing; held by Trevali NB; presently renewed until June 15, 2014; see note *** below 5. In good standing; held by Trevali Maritimes; presently to be renewed as of July 27, 2014 see below, note ***

**** PID 50237924 (the Leasehold Lands)**

Trevali NB has a leasehold interest in PID 50237924 as evidenced by the Surface Lease. The freehold lands are held by the New Brunswick Department of Natural Resources & Energy. Pursuant to our title search results, from January 1, 2012 forward, the underlying freehold is subject to the following encumbrances:

1. Easement #27017459 (registered on 2009-04-09) in favour of New Brunswick Power Transmission Corporation, which easement is over a small portion (approximately 20m x 30m) of the Subject PID, being Lot 93-1, Plan 3255, which is near the Settling pond at Caribou Lake;

2. Mining Lease No. ML-246, as well as the Surface Lease;

3. Fern Trust's 10% Net Profits Interest in the Caribou Mine as described above; and

4. A Debenture in favor of RMB Australia Holdings Limited and RMB Resources Limited registered in the Restigouche County Registry Office on April 26th, 2013 as document no. 32606890.

The leasehold interest of Trevali NB in and to the Surface Lease is subject to the following encumbrances:

1. A Debenture in favor of RMB Australia Holdings Limited and RMB Resources Limited registered in the Restigouche County Registry Office on April 26th, 2013 as document no. 32606890.

We have not searched title to the underlying freehold interest of the New Brunswick Department of Natural Resources & Energy prior to January 1, 2012.

***** PID 50072032 (the Freehold Lands)**

The Freehold Interest in PID 50072032, Mineral Claim 1773 (Woodside Brook) and Mining Lease ML-246 are subject to a 10% Net Profits Interest in the Caribou Mine, in favour of the Fern Trust. The 10% Net Profits Interest in the Caribou Mine, in favour of the Fern Trust, is an encumbrance which affects PID 50072032, notwithstanding that it is not listed on the CRO and subject to a Debenture in favor of RMB Australia Holdings Limited and RMB Resources Limited registered in the Restigouche County Registry Office on April 26th, 2013 as document no. 32606890

Mining Lease ML-246 is also subject to a Limited Environmental Liability Agreement dated as of January 30th, 2013 and is further subject to a Debenture in favor of RMB Australia Holdings Limited and RMB Resources Limited.

SCHEDULE "C"
Registrations Completed and Renewals or Amendments Required

The Debenture was registered in the New Brunswick Land Registry System in Restigouche County as document No. 33813586 on May 30th, 2014 against the Leasehold Lands;

The Debenture was registered in the New Brunswick Land Titles System as document No. 33812364 on May 29th, 2014 against the Freehold Lands (PID 50072032);

The Debenture was filed with the Recorder of Mines under the *Mining Act* (New Brunswick) as an encumbrance against the Mining Leases and the Active Claims, on May 29th, 2014;

The Debenture was filed with the Department of Natural Resources (New Brunswick) on May 29th, 2014, as an encumbrance against the Surface Lease.

Financing statements were registered in the Personal Property Registry of New Brunswick as Registration Number 24385494 against Trevali Maritimes and Registration Number 24385502 against Trevali NB, in respect of the Security Documents, which registrations will expire on 2021-05-16 if not properly renewed before the anniversary date of the said registrations in the last year of the then current registrations, which renewal is necessary in order to maintain the registrations; it will be the Agent's responsibility to attend to the task of renewing the registrations before their expiration, if appropriate; Cox & Palmer takes no responsibility for attending to the task of renewing the said registrations.

CERTIFICATE

TO: **Computershare Trust Company of Canada, as trustee and collateral agent (the "Collateral Agent")**

AND TO: **Aird & Berlis LLP**

AND TO: **Blake, Cassels & Graydon LLP**

AND TO: **Cox & Palmer LLP**

DATED: **May 30, 2014**

RE: **A note indenture dated May 30, 2014 (the "Note Indenture"), made among Trevali Mining Corporation (the "Corporation") and the Collateral Agent**

The undersigned, Anna Ladd, Chief Financial Officer of Trevali Mining (New Brunswick) Ltd. (the "**Corporation**"), hereby certifies for and on behalf of the Corporation that, to the best of my knowledge, information and belief, after due inquiry and without personal liability:

1. The minute books and corporate records of the Corporation for the period from the date of incorporation of the Corporation to the date hereof, which have been made available to Cox & Palmer LLP, are the original minute books and corporate records of the Corporation and contain all proceedings of the shareholders and the Board Of Directors (and any committees thereof) of the Corporation, or copies of such proceedings, to the date hereof and there have been no other meetings, resolutions or proceedings authorized or passed by the shareholders or by the board of directors of the Corporation. There are no other shareholder agreements, by-laws, meetings, resolutions or proceedings of the shareholders or directors (and any committees thereof) of the Corporation, from the date of the incorporation of the Corporation to the date hereof, not reflected in such minute books and corporate records.

2. No amendment or other document relating to or affecting the articles of the Corporation has been authorized or filed under the laws of the Province of New Brunswick since the receipt of a Certificate of Articles of Amalgamation dated November 2, 2012.

3. The Corporation has not taken any steps to terminate its existence, to surrender or cancel its articles of incorporation, to amalgamate, to continue in any other jurisdiction or to change its corporate existence in any way since the date of its incorporation under the laws of the Province of New Brunswick. The Corporation has not received any notice or other communication from any person or governmental authority indicating that there exists any situation which, unless remedied, could result in the termination of the existence of the Corporation.

4. The Corporation is not insolvent, no acts or proceedings have been taken by or against the Corporation in connection with, and the Corporation has not received any notice in respect of and the Corporation is not in the course of, any liquidation, winding-up, dissolution, bankruptcy or reorganization.

F#120261 *Officer's Certificate – Trevali Mining (New Brunswick) Ltd.*

respect of and the Corporation is not in the course of, any liquidation, winding-up, dissolution, bankruptcy or reorganization.

5. The Corporation has not received notice of any proceedings to cancel its Certificate of Incorporation or otherwise to terminate its existence.

6. Attached to this certificate as Schedule A is a complete and correct copy of all the articles of the Corporation and such articles are in full force and effect on the date hereof, unamended.

7. Attached to this certificate as Schedule B is a complete and correct copy of all of the by-laws of the Corporation and any amendments thereto and such by-laws, as so amended, are in full force and effect at the date hereof without further amendment.

8. Attached to this certificate as Schedule C is a complete and correct copy of resolutions passed in writing by the Board of Directors of the Corporation, which resolutions are in full force and effect, unamended, at the date hereof. There are no other resolutions of the Board of Directors dealing with the subject matter thereof.

9. The persons whose names appear on Schedule D attached to this certificate are duly elected or appointed officers of the Corporation who have held the offices indicated and that the signature of each person appears thereon. The Collateral Agent may conclusively rely upon this certificate as to the names and signatures of the officers of the Corporation until the Collateral Agent receives a further Certificate of Incumbency of the Corporation cancelling or amending this certificate and submitting the names and signature(s) of the officer(s) named in such further certificate.

10. As of the date hereof, the following persons are the beneficial and registered owners of all of the issued and outstanding shares of the Corporation:

Shareholder	No. and Class of Shares Owned
Trevali Mining Corporation	100 Common Shares

and there are no outstanding warrants, options or other agreements which require or may require the issuance or sale of any shares of any class of the Corporation, there are no outstanding securities convertible into shares of the Corporation and there are no unissued shares of the Corporation allotted for issuance to any person. The Corporation has received full consideration for the issuance of the outstanding shares of the Corporation, which issuance was authorized and approved by resolution of the Board of Directors of the Corporation

11. There is no litigation and, to the knowledge of the undersigned after having made reasonable inquiry, there are no legal proceedings pending or threatened against the Corporation before any court or administrative, governmental or regulatory agency or tribunal having jurisdiction over the Corporation.

The undersigned acknowledges that this certificate is to be relied upon by the addressees listed above and their respective successors and assigns in connection with opinions to be rendered in connection with the Note Indenture and related matters.

[*Signature Page Follows*]

IN WITNESS WHEREOF the undersigned has executed and delivered this certificate as of the date first written above.

Anna Ladd

Name: Anna Ladd
Title: Chief Financial Officer

F#120261 *Officer's Certificate - Trevali Mining (New Brunswick) Ltd.*

SCHEDULE A
ARTICLES OF THE CORPORATION

(See Attached)

F#120261 *Officer's Certificate – Trevali Mining (New Brunswick) Ltd.*

New Nouveau Brunswick

CANADA
PROVINCE OF NEW BRUNSWICK
BUSINESS CORPORATIONS ACT

CANADA
PROVINCE DU NOUVEAU-BRUNSWICK
LOI SUR LES CORPORATIONS COMMERCIALES

CERTIFICATE OF AMALGAMATION
(SECTION 124)

CERTIFICAT DE FUSION
(ARTICLE 124)

Trevali Mining (New Brunswick) Ltd.

Name of Corporation / Raison sociale de la corporation

666737

Corporation Number / Numéro de la corporation

I HEREBY CERTIFY that the above-mentioned corporation resulted from the amalgamation of the following corporations under the Business Corporations Act, as set out in the attached Articles of Amalgamation.

JE CERTIFIE que la corporation mentionnée ci-dessus provient de la fusion des corporations suivantes, en vertu de la Loi sur les corporations commerciales, de la façon indiquée dans les statuts de fusion ci-joints.

Director – Directeur

November 2, 2012 – le 2 novembre 2012

Date of Amalgamation – Date de fusion

BUSINESS CORPORATIONS ACT
FORM 6
ARTICLES OF AMALGAMATION
(SECTION 124)

LOI SUR LES CORPORATIONS COMMERCIALES
FORMULE 6
STATUTS DE FUSION
(ARTICLE 124)

1. Name of Corporation: / Raison sociale de la corporation:

Trevali Mining (New Brunswick) Ltd.

2. The classes and any maximum number of shares that the corporation is authorized to issue and any maximum aggregate amount for which shares may be issued including shares without par value and/or with par value and the amount of the par value: / Les catégories et le nombre maximal d'actions que la corporation peut émettre ainsi que le montant maximal global pour lesquelles les actions peuvent être émises y compris les actions sans valeur au pair ou avec valeur au pair ou les deux et le montant de la valeur au pair:

Unlimited number of common shares without nominal or par value and without limit as to aggregate amount.

3. Restrictions, if any, on share transfers: / Restrictions, s'il y en a, au transfert d'actions :

See Schedule "A" attached hereto.

4. Number (or minimum and maximum number) of directors: / Nombre (ou nombre minimum et maximum) des administrateurs :

Minimum of 1; Maximum of 9.

5. Restrictions, if any, on business the corporation may carry on: / Restrictions, s'il y en a, à l'activité que peut exercer la corporation :

None.

6. Other provisions, if any: / Autres dispositions, s'il y en a :

See Schedule "B" attached hereto.

7. (a) – The amalgamation has been approved by special resolutions of shareholders of each of the amalgamating corporations listed in Item 9 below in accordance with Section 122 of the *Business Corporations Act*. / a) – La fusion a été approuvée par les résolutions spéciales des actionnaires de chacune des corporations fusionnantes mentionnée à l'article 9 ci-dessous, conformément à l'article 122 de la Loi sur les corporations commerciales.

(b) – The amalgamation has been approved by a resolution of the directors of each of the amalgamation corporations listed in Item 9 below in accordance with Section 123 of the *Business Corporations Act*. These Articles of Amalgamation are the same as the Articles of Incorporation of (name the designated amalgamation corporation): / b) – La fusion a été approuvée par une résolution des administrateurs de chacune des corporations fusionnantes mentionnées à l'article 9 ci-dessous, conformément à l'article 123 de la Loi sur les corporations commerciales. Ces statuts de fusion sont les mêmes que les statuts constitutifs de (raison sociale de la corporation fusionnante désignée) :

8. Name of the amalgamating corporation the by-laws of which are to be the by-laws of the amalgamated corporation: / Raison sociale de la corporation fusionnante dont les règlements administratifs sont devenus les règlements administratifs de la corporation issue de la fusion :

Trevali Mining (New Brunswick) Ltd.

9. Name of Amalgamating Corporations / Raison sociale des corporations fusionnantes	Corporation No. / No. de corporation	Signature	Date	Description of Office / Fonction
Trevali Mining (New Brunswick) Ltd.	656967	Mark Cruise	October 24, 2012	President
Maple Minerals Corporation	647078	Francis Scola	October 22, 2012	President

FOR DEPARTMENT USE ONLY / RÉSERVÉ À L'USAGE DU MINISTÈRE

Corporation No. – No. de corporation: 666737

Filed – Déposé: FILED/DÉPOSÉ 2012 -11- 0 2

45-4107 (6/01)

SCHEDULE "A"

Restrictions on Share Transfers

As stipulated in any unanimous shareholders agreement. Shares in the corporation shall not be transferred without the consent of either the majority of the directors or the majority of the shareholders in writing.

FILED/DÉPOSÉ 2012 -11- 0 2

MAP - TITREVALI MINING CORPORATION\2127663 - purch Maple Minerals Corp assets\Amalgamation\Schedule A.doc

SCHEDULE "B"

The Corporation may, directly or indirectly, give financial assistance by means of a loan, guarantee or otherwise:

(a) to any shareholder, director, officer or employee of the corporation or of any affiliated corporation; or
(b) to any associate of a shareholder, director, officer or employee of the corporation or of an affiliated corporation;

notwithstanding that there may be reasonable grounds for believing that

(a) the corporation is, or after giving the financial assistance would be, unable to pay its liabilities as they become due; or
(b) the realizable value of the corporation's assets, excluding the amount of any financial assistance in the form of a loan or in the form of assets pledged or encumbered to secure a guarantee, after giving the financial assistance, would be less than the aggregate of the corporation's liabilities and stated capital of all classes.

Meetings of shareholders and/or meetings of directors of the corporation may be held at any place within or outside New Brunswick, Canada, in accordance with the New Brunswick Business Corporations Act, as amended from time to time.

FILED/DÉPOSÉ 2012 -11- 0 2

M:\P - T\TREVALI MINING CORPORATION\2127663 - purch Maple Minerals Corp assets\Amalgamation\Schedule B.doc

SCHEDULE B
BY-LAWS OF THE CORPORATION

(See Attached)

F#120261 *Officer's Certificate – Trevali Mining (New Brunswick) Ltd.*

A BY-LAW RELATING GENERALLY TO THE TRANSACTION OF THE BUSINESS AND AFFAIRS OF

TREVALI MINING (NEW BRUNSWICK) LTD.

BY-LAW NO. 1

From the Law Offices of
Barry Spalding
Saint John, NB

Page

A BY-LAW RELATING GENERALLY TO THE TRANSACTION OF THE BUSINESS AND AFFAIRS OF TREVALI MINING (NEW BRUNSWICK) LTD.

BY-LAW NO. 1

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A BY-LAW RELATING GENERALLY TO THE TRANSACTION OF THE BUSINESS AND AFFAIRS OF TREVALI MINING (NEW BRUNSWICK) LTD.

BY-LAW NO. 1

INTERPRETATION

1. **Definitions:** In this by-law and all other by-laws of the corporation, unless the context otherwise specifies or requires:-

(a) "**Act**" means the ***Business Corporations Act (New Brunswick)*** as amended from time to time and includes the regulations under the Act or any successor legislation;- in the event of successor legislation any reference in the by-laws to the Act or a provision of the Act shall be read as referring to the successor legislation or the provision substituted, as the case may be;

(b) "**articles**" means the articles of the corporation as from time to time amended and includes the original or restated articles of incorporation, and articles of amendment, amalgamation, continuance, reorganization, dissolution and revival;

(c) "**board**" means the board of directors of the corporation and include the sole director if only one.

(d) "**by-law**" means any by-law of the corporation from time to time in effect and includes, where the context requires, any amendment or substitution therefor;

(e) "**director**" means an individual occupying the position of a director of the corporation and "**directors**", "**board of directors**" or "**board**" includes a sole director;

(f) "**meeting of shareholders**" means an annual or a special meeting of shareholders;

(g) "**unanimous shareholder agreement**" means

(i) an agreement in writing between all the shareholders of the corporation, or between all the shareholders and a person who is not a shareholder, which restricts, in whole or in part, the powers of the directors to manage the business and affairs of the corporation; or

(ii) a declaration in writing by a person who is the beneficial owner of all of the issued shares of the corporation restricting, in whole or in part, the powers of the directors to manage the business and affairs of the corporation;

2. **Gender, etc.:** Words importing the singular include the plural and vice-versa;- words importing the masculine gender include the feminine and neuter genders and vice-versa;- words importing persons include bodies corporate, corporations, companies, partnerships, syndicates, associations and trusts.

3. **Headings:** Headings used in any by-law are inserted for reference only and are not to be considered in construing the provisions thereof or to be considered in any way to clarify, modify or explain the effect of any provisions thereof.

4. **Legislative Terms:** Any term contained in this or any other by-law which is defined in the Act shall have the meaning given in the Act.

5. **By-laws Subject To:** This by-law and all other by-laws of the corporation are to be interpreted, where the context requires, as being subject to the Act, the regulations under the Act, the articles and any unanimous shareholder agreement.

REGISTERED OFFICE, SEAL AND FISCAL PERIOD

6. **Registered Office:** The directors may from time to time by resolution fix the location of the address of the registered office of the corporation.

7. **Seals:** The corporation may have one or more seals which may be adopted and changed from time to time by resolution of the directors.

8. **Fiscal Year End:** The fiscal period of the corporation shall terminate on the day in each year the directors from time to time determine by resolution.

BANKING AND BORROWING

9. **Financial Institution Accounts:** The banking business of the corporation, or any part thereof, shall be transacted with a bank, trust company or other firm or corporation carrying on a banking business the directors may designate, appoint or authorize from time to time by resolution and all or any part of the banking business shall be transacted on the corporation's behalf by one or more officers, directors or other persons the board may designate, direct or authorize from time to time by resolution to the extent provided in the resolution including, without restricting the generality of the foregoing;-

(a) the operation of the corporation's accounts;

(b) the making, signing, drawing, accepting, endorsing, negotiating, allotting, depositing or transferring of any cheques, promissory notes, drafts, acceptances, bills of exchange and orders for the payment of money;

(c) the execution of any agreement relating to any banking business and defining the rights and powers of the parties thereto; and

(d) the authorizing of any officer or employee of the bank to do any act or thing on the corporation's behalf to facilitate its banking business.

10. **Borrowing:** Subject to the articles or a unanimous shareholder agreement, the directors of the corporation may from time to time:-

(a) borrow money upon the credit of the corporation;

(b) issue, reissue, sell or pledge debt obligations of the corporation; and

(c) mortgage, hypothecate, pledge or otherwise create a security interest in all or any property of the corporation owned or subsequently acquired to secure any debt obligation of the corporation; and

may, from time to time, may authorize any director or directors, or officer or officers of the corporation to enter into arrangements with respect to:-

(d) the money borrowed or to be borrowed;

(e) the terms and conditions of the loan; and

(f) the security to be given for the loan;

with power to vary or modify the arrangements, terms and conditions, and the security for the money borrowed or remaining due, and generally to manage, transact and settle the borrowing of money by the corporation.

EXECUTION OF INSTRUMENTS

11. **Agreements and Instruments in Writing:** Subject to a unanimous shareholder agreement, deeds, transfers, assignments, contracts, obligations and other instruments in writing requiring the signature of the corporation may be signed on behalf of the corporation by the President of the corporation and the corporate seal may be fixed to the instrument as required by any person authorized to sign on behalf of the corporation.

12. **Cheques and Bills of Exchange:** Subject to a unanimous shareholder agreement, all cheques, drafts, or orders for the payment of money, and all promissory notes, acceptances and bills of exchange requiring the signature of the corporation may be signed on behalf of the corporation by the President of the corporation and the corporate seal may be fixed to the instrument as required by any person authorized to sign on behalf of the corporation.

13. **Directors Resolution:** The directors are authorized from time to time by resolution to appoint any one or more of the officers or directors, or any other person (whether an officer or director of the corporation, on behalf of the corporation), to sign the instruments referenced in sections 11 or 12 generally or to sign specific instruments in writing.

14. **Binding on the Corporation:** All deeds, transfers, assignments, contracts, obligations, cheques, drafts, orders for the payment of money, promissory notes, acceptances, bills of exchange or other

instruments in writing signed in accordance with paragraphs 11, 12 or 13 shall be binding upon the corporation without any further authorization or formality.

DIRECTORS

15. **Powers:** The directors shall manage the business and affairs of the corporation and may exercise all powers and do all acts and things that may be exercised or done by the corporation and are not by the Act, the articles, a unanimous shareholder agreement, the by-laws, any special resolution of the corporation, or by statute or regulation expressly directed or required to be done in some other manner.

16. **Number:** The number of directors shall be two (2).

17. **Quorum:** Subject to a unanimous shareholder agreement, a majority of directors constitute a quorum for the transaction of business at a meeting of the directors. Notwithstanding vacancies the remaining directors may exercise all the powers of the board of directors for as long as a quorum of the board of directors remains in office.

18. **Qualifications:** Each director shall be an individual of nineteen (19) or more years of age. No individual shall be a director who

(a) has the status of a bankrupt;

(b) is of unsound mind and has been so found by a court in Canada or elsewhere; or

(c) is a person convicted of an offence under the Criminal Code of Canada in connection with the promotion, formation or management of a corporation, or convicted of an offence involving fraud unless three (3) years have elapsed since the expiration of the period fixed for suspension of the passing of sentence without sentencing or since a fine was imposed, or unless the term of imprisonment and probation imposed, if any, has been concluded, whichever is the latest, or unless a pardon has been granted.

19. **Director Disqualified:** If a director acquires the status of bankrupt, becomes, or is found to be of unsound mind, or is convicted of a criminal offence referred to in section 18 he shall immediately cease to be a director.

20. **Duties:** Every director and officer of the corporation in exercising his powers and discharging his duties shall

(a) act honestly and in good faith; and

(b) exercise the care, diligence and skill that a reasonably prudent person would exercise in comparable circumstances, in the best interests of the corporation.

21. **Election and Term:** Subject to a unanimous shareholder agreement, the directors are to be elected annually to hold office until the next annual meeting of the shareholders or until their successors have been

elected and are to be elected at each annual meeting and all the directors then in office are to retire. All directors, if qualified, are eligible for re-election. The election may be by a show of hands or by a resolution of the shareholders unless a ballot or poll is demanded by any shareholder.

22. **Pooled Voting:** Subject to a unanimous shareholder agreement or the articles, each shareholder entitled to vote at an election of directors has the right to cast the number of votes equal to the number of votes attached to the shares held by him multiplied by the number of directors to be elected, and he may cast all votes in favour of one (1) candidate or distribute them among the candidates in any manner.

23. **Separate Vote:** Subject to a unanimous shareholder agreement, a separate vote of shareholders shall be taken with respect to each candidate nominated for director unless a resolution of the shareholders is passed unanimously permitting two (2) or more persons to be elected by a single resolution.

24. **Retiring Director:** A retiring director retains office until the adjournment or termination of the meeting at which his successor is elected unless the meeting was called for the purpose of removing him or her from office as a director. In this event, the director is considered removed from his or her office as a director immediately upon the passing of the resolution removing him or her.

25. **Vacancies:** The office of a director shall ipso facto be vacated if

(a) he or she dies;

(b) by notice in writing to the corporation he or she resigns his or her office effective immediately, in accordance with its terms, or upon acceptance by the directors;

(c) he or she is removed from office in accordance with the provisions of the Act, the articles or a unanimous shareholder agreement; or

(d) he or she ceases to be qualified to be a director.

26. **Filling Vacancies:** Subject to a unanimous shareholder agreement, vacancies on the board of directors may be filled by a resolution of the directors, by a resolution in writing of the shareholders or by resolution at a special meeting of shareholders. If the remaining directors fail to call a meeting or if there are no directors in office, the meeting may be called by any shareholder.

27. **Validity of Acts:** An act by a director or officer is valid notwithstanding an irregularity in his or her election or appointment or a defect in his or her qualifications.

28. **Calling of Meetings:** Subject to the articles or a unanimous shareholder agreement, a meeting of the directors shall be held from time to time at a place, at a time and on a day the President determines and the secretary shall call meetings when directed or authorized by the President, or by any two (2) directors. Notice of every meeting is to be given to each director not less than Seventy-Two (72) hours (excluding any part of a Sunday or holiday) before the time when the meeting is to be held. No notice of a meeting is necessary if all the directors are present and do not object to the holding of the meeting, or all the directors have waived notice of the meeting.

29. **Notice:** Notice of a meeting of the directors shall specify any of the following matters that are to be dealt with at the meeting:-

(a) any question or matter requiring the approval of the shareholders;

(b) the filling of a vacancy among the directors, or if an auditor has been appointed, in the office of auditor;

(c) the issuing of securities;

(d) the declaration of dividends;

(e) the purchase, redemption or other acquisition of shares issued by the corporation;

(f) the payment of a commission concerning the issue of shares;

(g) the approval of financial statements of the corporation;

(h) the adoption, amendment or repeal of a by-law; and

(i) any other matter required by a unanimous shareholder agreement;

and, unless a by-law otherwise provides, the notice need not specify any other purpose or business to be transacted at the meeting.

30. **First Meeting of New Board:** Each newly elected board may, without notice, hold its first meeting for the purpose of organization and the election and appointment of officers immediately following the meeting of the shareholders at which the board was elected. A quorum of directors must be present at the meeting.

31. **Place of Meeting:** Subject to the articles or a unanimous shareholder agreement, meetings of the board may be held at the registered office of the corporation or at any other place within the municipality where the registered office is situate, or at any other place within or outside New Brunswick or elsewhere in Canada or the United States of America as the directors may, by resolution, determine.

32. **Participation by Telephone:** Subject to a unanimous shareholder agreement, a director may participate in any meeting of directors by telephone or other communications facilities that permit all persons participating in the meeting to hear each other, and a director participating in the meeting in this manner is deemed to be present at the meeting;- and a meeting of the directors may be held by telephone or other communications facilities that permit all persons participating in the meeting to hear each other.

33. **Votes to Govern:** Subject to a unanimous shareholder agreement, at all meetings of the board of directors every question shall be decided by a majority of the votes cast in favour or against the question and, in case of an equality of votes, the chairman of the meeting is not entitled to a second or casting vote.

34. **Remuneration:** The directors or any individual director of the corporation shall not be paid any remuneration unless authorized by the shareholders or a unanimous shareholder agreement. The directors are to be reimbursed for their out-of-pocket expenses incurred in attending board, committee or shareholders meetings, or in respect of the performance of his or her duties, as the board may from time to time determine.

35. **Transaction of Business by Signature:** Subject to a unanimous shareholder agreement, a resolution in writing, or counterparts of a resolution, signed by all directors entitled to vote on the resolution at a meeting of directors, is as valid as if it had been passed at a meeting of directors called and held for that purpose.

36. **Declaration of Interest:** Every director or officer of the corporation who is a party to a material contract, or a proposed material contract, with the corporation or who is the director or an officer of, or has a material interest in, any person who is a party to a material contract, or a proposed material contract, with the corporation shall disclose in writing to the corporation, or request to have entered in the minutes of meetings of directors, the nature and extent of his interest. All disclosures are to be made at the time required by the Act and directors are to refrain from participating in the decision and voting in respect of the material contract or proposed material contract if prohibited by the Act.

37. **Protection of Directors and Officers:** No director or officer of the corporation is liable for:-

(a) the acts, receipts, neglects or defaults of any other director or officer; or

(b) for joining in any receipts or other acts for conformity; or

(c) for any loss or expense happening to the corporation through the insufficiency or deficiency of title to any property acquired by the order of the board of directors on behalf of the corporation; or

(d) for the insufficiency or deficiency of any security in or upon which any of the moneys of the corporation shall be invested; or

(e) for any loss or damage arising from the bankruptcy, insolvency or tortious act of any person with whom any of the moneys, securities or effects of the corporation shall be deposited; or

(f) for any loss occasioned by error of judgment or oversight on his or her part; or
(g) for any loss, damage or misfortune whatever, which shall happen in the execution of the duties of his office or in relation thereto;

unless in or as a result of any action, suit or proceeding he or she is adjudged to be in breach of any duty or responsibility imposed on him or her as a director under the articles of the corporation, a unanimous shareholder agreement, the Act or any other statute.

38. **Indemnity of Directors and Officers:** The corporation shall indemnify the directors or officers of the corporation, former directors or officers of the corporation, or any person who acts or acted at the corporation's request as a director or officer of a body corporate of which the corporation is or was a shareholder or creditor, against all costs, charges and expenses (including an amount paid to settle an action or satisfy a judgment) reasonably incurred by him or her in respect of any civil, criminal or administrative

action or proceeding to which he or she has been made a party by reason of being or having been a director or officer of the corporation or body corporate if:-

(a) he or she acted honestly and in good faith with a view to the best interest of the corporation; and

(b) in the case of a criminal or administrative action or proceeding that is enforced by a monetary penalty, he or she had reasonable grounds for believing that his or conduct was lawful.

The corporation shall also indemnify a director or officer who has been substantially successful in the defence of any civil, criminal or administrative action or proceeding to which he or she is made a party by reason of being or having been a director or officer of the corporation or body corporate, against all costs, charges and expenses reasonably incurred by him or her in respect of the action or proceeding if the officer or director is fairly and reasonably entitled to an indemnity.

39. **Insurance for Directors and Officers:** The corporation may purchase and maintain insurance for the benefit of any director or officer against liabilities, costs, charges and expenses sustained or incurred by the director or officer for failure to exercise the care, diligence and skill that a reasonably prudent person would exercise in comparable circumstances.

40. **Submission of Contracts to Shareholders:** The directors in their discretion may submit any contract, act or transaction for approval, ratification or confirmation at any meeting of the shareholders called for the purpose of considering the same, and any contract, act or transaction that shall be approved, ratified or confirmed by resolution passed by a majority of the votes cast at the meeting (unless any other requirement is imposed by the Act, the articles, a unanimous shareholder agreement or a by-law) shall be as valid and as binding upon the corporation and upon all the shareholders thereof as though it had been approved, ratified or confirmed by every shareholder of the corporation.

OFFICERS

41. **Appointed Officers:** Subject to a unanimous shareholder agreement, at the first meeting of the board of directors after the annual election of shareholders, the directors shall elect the Chairman of the Board and the President, and shall appoint the Secretary, and the prior incumbent shall continue to hold office until the election or appointment and, in default of an election or appointment, continues to hold office after the meeting. If the office of Chairman of the Board, President or Secretary becomes vacant at any time, the vacancy shall be filled by the board. The board may also appoint a Chief Executive Officer, a Chief Operating Officer, a Vice-President or Vice-Presidents, a Secretary, a Treasurer, a Controller or Comptroller, Assistant-Secretaries or Assistant-Treasurers, a General Manager and such other officers as the board may from time to time designate. The officers appointed need not be members of the board and one person may hold more than one office other than the offices of President and Vice-President which must be held by different persons.

42. **Remuneration and Removal of Officers:** Subject to a unanimous shareholder agreement, the remuneration of all officers may be determined from time to time by the board, and the fact that any officer is a director or shareholder does not disqualify him or her from receiving remuneration.

action or proceeding to which he or she has been made a party by reason of being or having been a director or officer of the corporation or body corporate if:-

(a) he or she acted honestly and in good faith with a view to the best interest of the corporation; and

(b) in the case of a criminal or administrative action or proceeding that is enforced by a monetary penalty, he or she had reasonable grounds for believing that his or conduct was lawful.

The corporation shall also indemnify a director or officer who has been substantially successful in the defence of any civil, criminal or administrative action or proceeding to which he or she is made a party by reason of being or having been a director or officer of the corporation or body corporate, against all costs, charges and expenses reasonably incurred by him or her in respect of the action or proceeding if the officer or director is fairly and reasonably entitled to an indemnity.

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OFFICERS

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43. **Removal of Officers:** Subject to a unanimous shareholder agreement, all officers are subject to removal by resolution of the board at any time.

44. **Delegation of Duties of Officers:** In case of the absence or inability to act of the Chairman of the Board, the President, a Vice-President or any other officer of the Corporation, or for any other reason that the board may deem sufficient, the board may delegate the powers of such officer to any other person for the time being.

45. **Chairman of the Board:** The Chairman of the Board shall, if present, preside at all meetings of the board and shareholders, and he or she shall sign all instruments which require his or her signature and shall perform all duties incident to the office of Chairman of the Board, and shall have other powers and duties as may from time to time be assigned to the Chairman by the board.

46. **President:** The President shall in the absence of the Chairman of the Board and if present, preside at a meeting of directors or shareholders. He or she shall sign all instruments which require his or her signature and shall perform all duties incident to the office of president, and shall have such other powers and duties as may from time to time be assigned to him or her by the board.

47. **General Manager:** Subject to a unanimous shareholder agreement, the General Manager (if any) shall have the power to manage the business of the Corporation from time to time prescribed by resolution of the board.

48. **Vice-President:** During the President's absence or inability or refusal to act, the duties of president may be performed and his or her powers may be exercised by the Vice-President, or if there is more than one, by the Vice-Presidents in order of seniority or designation (as determined by the board), except that no Vice-President shall preside at a meeting of the board unless he or she is a director. A Vice-President shall also perform other duties and exercise other powers from time to time prescribed by resolution of the board.

49. **Secretary:** The Secretary shall give, or cause to be given, all notices required to be given to shareholders, directors, auditors and members of committees. He or she shall enter or cause to be entered in the books kept for that purpose minutes of all proceedings at the meetings of directors and shareholders, and shall be responsible for the custody of the corporate seal (if any) of the Corporation and of all records belonging to the Corporation, and shall perform such other duties as may from time to time be prescribed by resolution of the board.

50. **Treasurer:** The Treasurer shall have the care and custody of all the funds and securities of the Corporation and shall deposit the same in the name of the Corporation in a bank or banks, or with a depositary or depositories, the board may by resolution direct and shall at all reasonable times exhibit his or her books and accounts to any director upon request at the office of the Corporation during business hours. The Treasurer shall sign or countersign all instruments that require his or her signature and shall perform all duties incident to his or her office or that are properly required of him or her by resolution of the board. He or she may be required to give a bond for the faithful performance of his or her duties as the board in its uncontrolled discretion may require but no director shall be liable for failure to require

any bond or for the insufficiency of any bond, or for any loss by reason of the failure of the Corporation to receive any indemnity provided by a bond.

51. **Assistant-Secretary:** During the Secretary's absence, or inability or refusal to act, an Assistant-Secretary (if any) shall perform all the duties of the Secretary and an Assistant-Secretary shall also have such other powers and duties as may from time to time be assigned to him or her by resolution of the board.

52. **Assistant-Treasurer:** During the Treasurer's absence, or inability or refusal to act, an Assistant-Treasurer (if any) shall perform all the duties of the Treasurer and an Assistant Treasurer shall also have such other powers and duties as may from time to time be assigned to him or her by resolution of the board.

53. **Variation of Duties:** From time to time the board may vary, add to or limit the powers and duties of any officer.

54. **Fidelity Bonds:** The board may require the officers, employees and agents of the corporation they deem advisable to furnish bonds for the faithful discharge of their duties in the form and with the surety the board may from time to time prescribe.

SHARES

55. **Allotment:** Subject to the articles or to a unanimous shareholder agreement, the board of directors may from time to time allot or grant options to purchase the whole or any part of the authorized and unissued shares in the corporation to the person or persons or class of persons the board shall by resolution determine.

56. **Share Certificates:** Every shareholder is entitled, in the case of initial issuance without payment, and in the case of any subsequent transfer upon payment of a fee of not more than Three Dollars ($3.00), to a share certificate stating the number and class of shares held by him, her or it as shown on the books of the corporation. Share certificates shall be in the form the board of directors shall from time to time approve. Unless otherwise ordered by the board, share certificates shall be signed by the President or a Vice-President, and by the Secretary or the Treasurer or an Assistant-Secretary or Assistant Treasurer (if any are appointed) and need not be under the corporate seal.

57. **Replacement of Share Certificates:** The board may by resolution prescribe, either generally or in a particular case, reasonable conditions upon which a new share certificate may be issued in lieu of and upon cancellation of the share certificate which has become mutilated or in substitution for a certificate which has been lost, stolen or destroyed.

58. **Central Register:** The corporation shall maintain a central share register.

59. **Transfer of Shares:** Subject to the Act and the restrictions on transfer set forth in the articles or a unanimous shareholder agreement, transfers of shares of the corporation shall be effected only on the register of transfers kept by or for the corporation upon surrender of the share certificate or certificates properly endorsed together with any additional assurance the corporation shall require.

60. **Dealings with Registered Holder**: The corporation may treat as absolute owner of the share the person in whose name the share is registered in a share register as if that person had full legal capacity and authority to exercise all rights of ownership irrespective of any knowledge or notice to the contrary, or any description in its records or on the share certificate indicating a pledge, a representative or fiduciary relationship, a reference to any other instrument or the rights of any other person.

61. **Record Date Meetings:** Subject to the articles or a unanimous shareholder agreement, the directors may fix in advance a record date for the meeting of shareholders for the determination of persons entitled to receive notice of a meeting of shareholders, the date to precede by not more than fifty (50) days or by not less than twenty-one (21) days of the meeting, and notice thereof shall be given in accordance with the provisions of the Act, the articles or a unanimous shareholder agreement.

62. **Record Date Participation:** Subject to the articles or a unanimous shareholder agreement, the directors may fix in advance a date as the record date for determination of shareholders entitled to receive payment of a dividend, or to participate in a liquidation or distribution, or for any other purpose except the right to receive notice of or to vote at a meeting and the record date shall not precede by more than fifty (50) days the date on which the particular action is to be taken.

63. **No Record Dated Fixed:** If no record date is fixed

(a) the record date for the determination of the shareholders entitled to receive notice of a meeting of the shareholders shall be

(i) at the close of business on the day immediately preceding the day on which the notice is given; or

(ii) if no notice is given, the day on which the meeting is held; and

(b) the record date for the determination of shareholders for any purpose other than to vote shall be at the close of business on the day on which the directors pass the resolution for the intended purpose.

SHAREHOLDERS

64. **Annual Meeting:** Subject to the articles and a unanimous shareholder agreement, the annual meeting of shareholders shall be held at or near Saint John, New Brunswick (or at any other place within or outside New Brunswick or Canada if authorized by the articles) at the time and on the day in each year the directors may determine for the purpose of hearing and receiving the reports and statements required by the Act to be read and submitted to the shareholders at any annual meeting electing directors, appointing, if necessary, the auditor and fixing or authorizing the board of directors to fix his or her remuneration, and for the transaction of such other business as may properly be brought before the meeting.

65. **Special Meeting:** Subject to a unanimous shareholder agreement, the President alone or, a Vice-President and the Secretary acting together, or any two (2) directors, may call a special meeting of the shareholders to be held at or near Saint John, New Brunswick at the time and place specified in the notice calling the meeting.

66. **Notice of Meetings:** No public notice or advertisement of any meeting of shareholders is required. Subject to the articles or a unanimous shareholder agreement, notice of the time and place of each meeting of shareholders is to be given not less than twenty-one (21) days nor more than fifty (50) days (or on a lesser notice period if authorized by the Act, the articles or a unanimous shareholder agreement) before the day on which the meeting is to be held, to the auditor, if any, the directors and to each shareholder of record entitled to vote at the meeting. Notice of a special meeting of shareholders shall state the nature of the business to be transacted in sufficient detail to permit the shareholder to form a reasoned judgment together with the text of any special resolution to be submitted to the meeting. A meeting of shareholders may be held at any time without notice if all the shareholders entitled to vote are present or represented by proxy, and do not object to the holding of the meeting, or those not present or represented by proxy have waived notice, if all the directors are present or have waived notice, and if the auditor (if any) is present or has waived notice.

67. **Reports to Shareholders:** Subject to the articles or a unanimous shareholder agreement, a copy of the financial statements and a copy of the auditor's report, if any, shall be sent to each shareholder not less than ten (10) days, or such shorter period as may be consented to by the shareholder, before each annual meeting of shareholders or before the transaction of the annual business of the corporation.

68. **Persons Entitled to Be Present:** Persons entitled to attend a meeting of shareholders are shareholders entitled to vote, the directors, the auditor (if any) of the corporation and others who, although not entitled to vote, are entitled or required under the provisions of the Act, a unanimous shareholder agreement or by-laws to be present at the meeting. Any other person may be admitted with the consent of the meeting.

69. **Quorum:** Subject to the articles or a unanimous shareholder agreement, a majority of the shareholders personally present or represented by proxy constitutes a quorum for a meeting of shareholders.

70. **Right to Vote:** Subject to the articles or a unanimous shareholder agreement, at each meeting of shareholders every shareholder is entitled to vote who is entered on the books of the corporation as a holder of one or more shares carrying the right to vote at the meeting or, where a record date has been fixed, satisfactory evidence is produced not later than ten (10) days before the meeting that the person owns shares in the corporation and demands that his, her or its name be included on the list of shareholders entitled to vote at the meeting. If the share or shares in question have been mortgaged or hypothecated, the person who mortgaged or hypothecated the share or shares (or his, her or its proxy) may nevertheless represent the shares at meetings and vote in respect of the shares unless in the instrument creating the mortgage or hypothec he, she or it has expressly empowered the holder of the mortgage or hypothec to vote the shares, in which case the holder (or his or her proxy) may attend meetings to vote in respect of such shares upon filing with the President or the secretary of the meeting sufficient proof of the terms of the instrument.

71. **Joint Shareholders:** If two or more persons hold shares jointly, one of those holders present at a meeting of shareholders may, in the absence of the others, vote the shares, but if two or more of those persons who are present, in person or by proxy, vote, they shall vote as one on the shares jointly held by them.

72. **Representatives:** An executor, administrator, committee of a mentally incompetent person, guardian or trustee, and where a corporation is an executor, administrator, committee, guardian or trustee of a testator, intestate, mentally incompetent person, ward or cestui que trust, any person duly appointed a proxy for that corporation, upon filing with the President or secretary of the meeting sufficient proof of his or her appointment, shall represent shares held in his, her or its hands at all meetings of the shareholders of the corporation and may vote as a shareholder in the same manner and to the same extent as the shareholder of record.

73. **Proxies:** Subject to the articles or a unanimous shareholder agreement, a shareholder entitled to vote at a meeting of shareholders may by means of a proxy appoint a proxyholder and one or more alternate proxyholders who are not required to be shareholders to attend and act at the meeting in the manner and to the extent authorized by the proxy and with the authority conferred by the proxy. A proxy shall be executed by the shareholder or by his, her, or its attorney authorized in writing, and a proxy shall contain the date thereof and the appointment and name of the proxyholder, and may contain a revocation of a former proxy and restrictions, limitations or instructions as to the manner in which the shares in respect of which the proxy is given are to be voted, or a restriction or limitation as to the number of shares in respect of which the proxy is given.

A proxy is valid only at the meeting in respect of which it is given or any adjournment thereof unless otherwise specifically stated to be valid for all or any other meeting or meetings of shareholders until revoked or replaced.

74. **Revocation of Proxies:** In addition to revocation in any other manner permitted by law, a shareholder may revoke a proxy by depositing an instrument in writing executed by the shareholder or by his attorney duly authorized in writing

(a) at the registered office of the Corporation at any time up to and including the last business day preceding the day of the meeting, or an adjournment thereof, at which the proxy is to be used, or

(b) with the chairman of the meeting on the day of the meeting or an adjournment thereof.

If a person who executes a proxy attends in person at the meeting, or any adjournment of the meeting, at which the proxy is to be used, the proxy shall be considered to be revoked.

75. **Deposit of Proxies:** The board may specify in a notice calling a meeting of shareholders a time not exceeding forty-eight (48) hours (excluding Saturdays, Sundays and statutory holidays in New Brunswick) preceding the meeting or an adjournment thereof before which time proxies to be used at the meeting must be deposited with the Corporation or its agent.

76. **Proxy Regulations:** The board may from time to time pass resolutions establishing regulations regarding the lodging of proxies at some place or places other than the place at which a meeting or adjourned meeting of shareholders is to be held and for particulars of proxies to be cabled or telegraphed, or sent by facsimile or other electronic means of transmission or sent in writing before the meeting or adjourned meeting to the Corporation or any agent of the Corporation for the purpose of receiving such particulars and providing that proxies so lodged may be voted upon as though the proxies themselves were produced at the meeting or adjourned meeting, and votes given in accordance with such regulations shall be valid and shall be counted. The chairman of any meeting of shareholders may, subject to any regulations made as aforesaid, in his discretion accept telegraphic or cable, or by facsimile or other electronic means of transmission or written communication as to the authority of anyone claiming to vote on behalf of and to represent a shareholder notwithstanding that no proxy conferring such authority has been lodged with the Corporation, and any votes given in accordance with such telegraphic or cable, or by facsimile or other electronic means of transmission or written communication accepted by the chairman shall be valid and shall be counted.

77. **Scrutineers:** At each meeting of shareholders one or more scrutineers may be appointed by a resolution of the meeting, or by the Chairman with the consent of the meeting, to serve the meeting. The scrutineers need not be shareholders of the corporation.

78. **Votes to Govern:** At all meetings of shareholders every question shall, unless otherwise required by the articles, a unanimous shareholder agreement, the by-laws, the Act or by law, be decided by a majority of votes cast on the question.

79. **Show of Hands:** Subject to a unanimous shareholder agreement, at all meetings of shareholders every question shall be decided by a show of hands unless a secret ballot or a poll is required by any shareholder present in person or represented by proxy. On a show of hands every shareholder present in person (or their proxy) has one (1) vote.

80. **Poll:** Subject to the Act, the articles or a unanimous shareholder agreement, the decision of the shareholders in an annual or special meeting taken by poll is to be decided by a majority of the shareholders voting all of their shares for or against the question.

81. **Casting Vote:** Subject to a unanimous shareholder agreement, in case of an equality of votes at any meeting of shareholders, either upon a show of hands or upon a poll, the Chairman of the meeting is not entitled to a second or casting vote.

82. **Adjournment:** Subject to a unanimous shareholder agreement, the Chairman of a meeting of shareholders may, with the consent of the meeting and subject to the conditions the meeting may decide, adjourn the meeting from time to time and from place to place.

83. **Participation by Telephone:** Subject to the articles or a unanimous shareholder agreement, a shareholder may participate in any meeting of shareholders at which he, she or it is entitled to attend by telephone or other communications facilities that permit all persons participating in the meeting to hear each other, and a shareholder participating in the meeting by means of communication facilities is deemed to be present at the meeting, and a meeting of the shareholders may be held by telephone or other communications facilities that permit all persons participating in the meeting to hear each other, and a meeting held by in this manner shall be considered to be a meeting of the shareholders.

84. **Transaction of Business by Signature:** Subject to a unanimous shareholder agreement, a resolution in writing, or counterparts of the resolution, signed by all the shareholders entitled to vote on the resolution at a meeting of shareholders, and a resolution in writing dealing with all matters required by the Act, the articles or by a unanimous shareholder agreement to be dealt with at a meeting of shareholders and signed by all the shareholders entitled to vote at that meeting, are as valid and effective as if passed at a meeting of the shareholders duly called, constituted and held for that purpose.

85. **Dividends:** Subject to a unanimous shareholder agreement, the board may from time to time declare dividends payable to the shareholders according to their respective rights and interests in the corporation unless there are reasonable grounds for believing that

(a) the corporation is, or would after payment of all or part thereof, be unable to pay its liabilities as they become due; or

(b) the realizable value of the corporation's assets is, or would after payment of all or part thereof, be less than the aggregate of its liabilities and stated capital of all classes.

The corporation may pay a dividend in money or property, or by issuing fully paid shares of the corporation.

86. **Payment of Dividends:** A dividend payable in money shall be paid by cheque drawn on the corporation's bank or other depository, or one of them to the order of each registered holder of shares of the class in respect of which it has been declared, and mailed by ordinary mail, postage prepaid, to such registered holder at his, her or its last address appearing on the books of the corporation. In the case of joint holders the cheque shall, unless the joint holders otherwise direct, be made payable to the order of all joint holders and, if more than one address appears on the books of the corporation in respect of the joint holding, the cheque shall be mailed to the first address so appearing. The mailing of the cheque shall satisfy and discharge all liability for the dividend to the extent of the sum represented thereby unless the cheque is not paid at par on due presentation. In the event of non-receipt of any cheques for dividends by the person to whom it is sent, the corporation on proof of non-receipt and upon satisfactory indemnity being given to it, shall issue to the person a replacement cheque for a like amount.

NOTICES

87. **Method of Giving:** Subject to a unanimous shareholder agreement, any notice, communication or other document to be given by the corporation to a shareholder, director, officer or auditor of the corporation under any provision of the articles or by-laws shall be sufficiently given

(a) if delivered personally to the person to whom it is to be given or if delivered to the person's last address recorded in the books of the corporation; or

(b) if mailed by prepaid ordinary or air mail in a sealed envelope addressed to the person at their last address recorded in the books of the corporation; or

(c) if sent by means of wire or wireless or by facsimile transmission or any other form of electronic transmitted or recorded communication.

The President or the Secretary may change the address of a shareholder on the books of the corporation in accordance with any information believed by him or her to be reliable. A notice, communication or document so delivered shall be deemed to have been given when it is delivered personally or at the change of address;- a notice, communication or document mailed shall be deemed to have been given when deposited in a post office or public letter box;- and a notice sent by any means of wire or wireless, facsimile transmission or any other form of electronically transmitted or recorded communication shall be deemed to have been given when delivered to the appropriate communication company or agency or its representative for dispatch.

88. **Computation of Time:** In computing the date when notice must be given under any provision of the articles or by-laws requiring a specified number of days' notice of any meeting or other event, the date of giving the notice and the date of the meeting or other event shall be excluded.

89. **Errors or Omissions:** The accidental omission to give any notice to any shareholder, director, officer or auditor, or any error in any notice not affecting its substance shall not invalidate any action taken at any meeting held pursuant to the notice or otherwise founded thereon.

90. **Notice to Joint Holders:** All notices with respect to any shares registered in more than one name may, if more than one address appears on the books of the corporation in respect of a joint holding, be given to the joint shareholders at the first address appearing on the books, and notice so given is sufficient notice to all the holders of the shares.

91. **Persons Entitled by Death or Operation of Law:** Every person who by operation of law, transfer, death of a shareholder or by any means whatsoever, becomes entitled to any share or shares, shall be bound by every notice in respect of the share or shares which has been duly given to the person from whom he or she derives his or her title to the share or shares, prior to his or her name and address being entered on the books of the corporation (whether it be before or after the happening of the event upon which he or she became entitled).

92. **Waiver of Notice:** Any shareholder, director, officer or auditor may waive any notice required to be given under any provision of the Act, articles, a unanimous shareholder agreement or by-laws of the corporation, and the waiver, whether given before or after the meeting or other event of which notice is required to be given, shall cure any default in giving the required notice.

ENACTED April 13, 2011.

WITNESS the corporate seal of the corporation.

President

SCHEDULE C

RESOLUTION OF THE BOARD OF DIRECTORS
OF
TREVALI MINING (NEW BRUNSWICK) LTD.
(the "Corporation")

WHEREAS:

A. Trevali Mining Corporation (the "**Issuer**") propose to enter into a note indenture, dated as of the date hereof, among, *inter alios*, the Issuer and Computershare Trust Company of Canada, as trustee and collateral agent (the "**Collateral Agent**") (as amended, restated, supplemented or replaced from time to time, the "**Note Indenture**");

B. In connection with the foregoing, the Corporation is required to execute and deliver certain security to the Collateral Agent; and

C. The Issuer is the sole shareholder of the Corporation and has agreed to assign, hypothecate and pledge to and in favour of the Collateral Agent all of the issued and outstanding equity interests in the capital of the Corporation as collateral security for the repayment of the obligations owing under the Note Indenture upon and subject to the terms and conditions of the General Security Agreement (as defined herein) between the Issuer and the Collateral Agent dated as of the date hereof.

RESOLVED THAT:

1. As general and continuing collateral security for the performance of all obligations, both present and future, contingent or otherwise, of the Corporation owed to the Collateral Agent, the Corporation be and it is hereby authorized to execute and deliver a certain guarantee agreement in favour of the Collateral Agent upon and subject to the terms and conditions contained in the form of guarantee agreement presented to the directors of the Corporation (the "**Guarantee**").

2. As general and continuing collateral security for the performance of all obligations, both present and future, contingent or otherwise, of the Corporation owed to the Collateral Agent, the Corporation be and it is hereby authorized to mortgage and charge the property and assets of the Corporation as more particularly described in and upon and subject to the terms and conditions set forth in a certain general security agreement (the "**General Security Agreement**").

3. The assignment, hypothecation and pledge to and in favour of the Collateral Agent of all of the issued and outstanding equity interests in the capital of the Corporation by the Issuer, as collateral security for the repayment of its obligations owing to the Collateral Agent, pursuant to the General Security Agreement, and the transfer of such shares contemplated by such assignment, hypothecation and pledge, and the transfer of such shares by the Collateral Agent or its nominee to one or more third parties in the event of realization by the Collateral Agent pursuant to the General Security Agreement be and they are hereby approved and consented to by the directors of the Corporation.

F#120261 *Officer's Certificate – Trevali Mining (New Brunswick) Ltd.*

4. Any one officer or director of the Corporation is hereby authorized, on behalf of the Corporation:

   (a) to execute (under corporate seal or otherwise) and deliver the Guarantee, General Security Agreement and all other documents, instruments, agreements, security and writings required in connection with or contemplated by any of the foregoing as may be necessary to consummate the transactions contemplated herein (collectively, the "**Transaction Documents**"), in such form and containing such terms and conditions as such officer, director or authorized signing officer executing the same may approve, with such alterations, additions, amendments and deletions as such officer or director executing the same may approve (such approval to be conclusively deemed to be proved by the execution and delivery thereof); and

   (b) to do all such acts and things as he or she may, in his or her discretion, consider necessary, advisable or desirable in connection with or as contemplated by or for the purpose of giving effect to or carrying out the provisions of the Transaction Documents and this resolution and the execution and delivery of any such Transaction Documents and taking of any such actions in accordance with this section shall be conclusive evidence of such determination.

5. All acts performed and any documents executed, delivered, filed or registered prior to the date of this resolution by the director or officers of the Corporation or any authorized person pursuant to this resolution, acting for and on behalf of the Corporation, relating to matters dealt with in this resolution be and are hereby approved, ratified and confirmed.

6. This resolution may be executed in several counterparts, which together shall constitute one and the same resolution. This resolution may be executed by facsimile or electronic transmission in portable document format ("**PDF**") and the delivery of an executed counterpart copy of this resolution by facsimile or PDF shall be deemed to be the equivalent of the delivery of an originally executed counterpart copy thereof.

7. The foregoing resolution is hereby consented to by the directors of the Corporation pursuant to the provisions of the *Business Corporations Act* (New Brunswick).

SCHEDULE D

CERTIFICATE OF INCUMBENCY

Name	Title	Signature
Mark Cruise	President and Chief Executive Officer	
Anna Ladd	Chief Financial Officer	

F#120261 *Officer's Certificate – Trevali Mining (New Brunswick) Ltd.*

SCHEDULE D

CERTIFICATE OF INCUMBENCY

Name	Title	Signature
Mark Cruise	President and Chief Executive Officer	
Anna Ladd	Chief Financial Officer	Anna Ladd

F#120261 *Officer's Certificate – Trevali Mining (New Brunswick) Ltd.*

CERTIFICATE OF QUALIFIED PERSON

To accompany the report entitled *Technical Report on Preliminary Economic Assessment for the Halfmile-Stratmat Massive Sulphide Zinc-Lead-Silver Integrated Project Bathurst, New Brunswick, Canada* dated October 26, 2017 with effective date of October 26, 2017.

I, Benny Zhang, PEng, do hereby certify that:

1) I am a Principal Consultant (Mine Engineering) with the firm of SRK Consulting (Canada) Inc. with an office at Suite 1500, 155 University Avenue, Toronto, Ontario, M5H 3B7;
2) I graduated with a Bachelor of Engineering degree in Mining Engineering from Central South University, China in 1984, and a Master of Engineering degree in Applied Rock Mechanics for Mine Planning from McGill University, Canada in 2006. I have practiced my profession for 33 years. I have been directly involved in mine operations, mine design and planning, technical review and audit, due diligence, mining project valuation, equipment selection, ventilation, rock mechanics and ground support, and providing various technical services for more than 50 base metal and precious metal mines / projects, including base metal sulphide deposit projects. Since 2000 I have been focusing my career on mining project related consulting services worldwide
3) I am a Professional Engineer registered with Professional Engineers Ontario (PEO#100115459);
4) I have personally inspected the Halfmile and Stratmat project site between July 7 and 9, 2015, and visited the Caribou project site between April 26 and 28, 2016;
5) I have read the definition of Qualified Person set out in National Instrument 43-101 and certify that by virtue of my education, affiliation to a professional association, and past relevant work experience, I fulfill the requirements to be a Qualified Person for the purposes of National Instrument 43-101 and this technical report has been prepared in compliance with National Instrument 43-101 and Form 43-101F1;
6) I, as a Qualified Person, am independent of the issuer as defined in Section 1.5 of National Instrument 43-101;
7) I am the co-author of this report and responsible for Sections 1 to 2, 4, 14, 15, 18, 21-22, and parts of Sections ES, 23-26, and accept professional responsibility for those sections of this technical report;
8) I have not had any prior exposure to the subject property;
9) I have read National Instrument 43-101 and confirm that this technical report has been prepared in compliance therewith;
10) SRK Consulting (Canada) Inc. was retained by Trevali Mining Corporation to prepare a preliminary economic assessment, including mineral resource statements, for the Halfmile-Stratmat integrated project located in New Brunswick, Canada in accordance with National Instrument 43-101 and Form 43-101F1 guidelines. This assignment was completed using CIM Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines and Canadian Securities Administrators' National Instrument 43-101 guidelines;
11) I have not received, nor do I expect to receive, any interest, directly or indirectly, in the Halfmile-Stratmat massive sulphide integrated project or securities of Trevali Mining Corporation; and
12) That, as of the effective date of this technical report, to the best of my knowledge, information and belief, this technical report contains all scientific and technical information that is required to be disclosed to make the technical report not misleading.

["signed and sealed"]

Toronto, Ontario
October 26, 2017

Benny Zhang, PEng (PEO#100115459)
Principal Consultant (Mine Engineering)

CERTIFICATE OF QUALIFIED PERSON

To accompany the report entitled *Technical Report on Preliminary Economic Assessment for the Halfmile-Stratmat Massive Sulphide Zinc-Lead-Silver Integrated Project Bathurst, New Brunswick, Canada* dated October 26, 2017 with effective date of October 26, 2017.

I, Dr. Gilles Arseneau, PGeo. do hereby certify that:

1) I am an associate consultant with the firm of SRK Consulting (Canada) Inc. with an office at Suite 2200, 1066 West Hastings Street, Vancouver, British Columbia, Canada;
2) I am a graduate of University of New Brunswick with a BSc (Geology) degree obtained in 1979, the University of Western Ontario with an MSc (Geology) degree obtained in 1984 and the Colorado School of Mines with a PhD (Geology) obtained in 1995. I have practiced my profession continuously since 1995. I have worked in exploration in North and South America and have several years of experience modelling volcanogenic massive sulphide mineralization similar to the mineralization found on the Halfmile-Stratmat integrated project;
3) I am a Professional Geoscientist registered with the Association of Professional Engineers & Geoscientists of British Columbia (no. 23474);
4) I have personally inspected the subject project on November 24 and 25, 2014 and on May 27 and 28, 2016;
5) I have read the definition of Qualified Person set out in National Instrument 43-101 and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a Qualified Person for the purposes of National Instrument 43-101 and this technical report has been prepared in compliance with National Instrument 43-101 and Form 43-101F1;
6) I, as a Qualified Person, I am independent of the issuer as defined in Section 1.5 of National Instrument 43-101;
7) I am co-author of this report and responsible for sections 3.1, 3.2, 5 to 11, 13, 24 to 26 and parts summarized in the the Executive Summary and accept professional responsibility for those sections of this technical report;
8) I have had prior involvement with the subject property. I am the author of a technical reprt on the Halfmile Lake-Stratmat Lead-zinc Proejct, Bathurst, New Brunswick dated August 20, 2016;
9) I have read National Instrument 43-101 and confirm that this technical report has been prepared in compliance therewith;
10) SRK Consulting (Canada) Inc. was retained by Trevali Mining Corporation to prepare a preliminary economic assessment, including mineral resource statements, for the Halfmile-Stratmat integrated project located in New Brunswick, Canada in accordance with National Instrument 43-101 and Form 43-101F1 guidelines. This assignment was completed using CIM Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines and Canadian Securities Administrators' National Instrument 43-101 guidelines;
11) I have not received, nor do I expect to receive, any interest, directly or indirectly, in the Halfmile-Stratmat integrated project securities of Trevali Mining Corporation; and
12) That, as of the effective date of this technical report, to the best of my knowledge, information and belief, this technical report contains all scientific and technical information that is required to be disclosed to make the technical report not misleading.

["signed and sealed"]

Vancouver, B.C.
October 26, 2017

Dr. Gillesa Arseneau, PGeo
Assocaite Consultant

CERTIFICATE OF QUALIFIED PERSON

To accompany the report entitled *Technical Report on Preliminary Economic Assessment for the Halfmile-Stratmat Massive Sulphide Zinc-Lead-Silver Integrated Project Bathurst, New Brunswick, Canada* dated October 26, 2017 with effective date of October 26, 2017.

I, Gary Poxleitner, do hereby certify that:

1) I am a Principal Consultant (Mining Engineering) with the firm of SRK Consulting (Canada) Inc. ("SRK") with an office at Suite 101, 1984 Regent Street South, Sudbury, Ontario, Canada;
2) I am a graduate of the Laurentian University in Sudbury, Ontario in 1991, I obtained a Bachelor of Engineering degree. I have practiced my profession continuously since 1991. I have over 27 years of operational, engineering, management, and consulting experience. I have worked primarily in underground mines including blast hole open stope, sub-level caving and narrow vein mining in commodities such as base metals, gold, silver, diamonds, salt, copper and uranium. I have managed complex studies, including mine optimization; budgeting and cost estimation; economic evaluations; due diligence and independent review; as well as mine audits. I have also been engaged in the process of converting Mineral Resources to Mineral Reserve estimates. Following graduation I was employed with El-Equip, in mine communication automation and with Anrep in engineering. Starting in 1994, I was employed by Royal Oak Mines, as Ventilation Engineer for the underground mine operations, at Giant Mine in Yellowknife, Northwest Territories. Beginning in 1997, I was employed by Boliden-Westmin, as a Mine Engineer in Campbell River, British Columbia. Commencing in 2001, I was employed by Vale as a Project Manager, Mine Supervisor, Mine Engineer Supervisor in Sudbury, Ontario. Since joining SRK Consulting in 2011, I have been engaged in technical engineering studies, capital and operating cost estimation, operations improvement, due diligence and economical modelling;
3) I am a Professional Engineer registered with Professional Engineers Ontario (PEO#100015286);
4) I have personally not visited the site;
5) I have read the definition of Qualified Person set out in National Instrument 43-101 and certify that by virtue of my education, affiliation to a professional association, and past relevant work experience, I fulfill the requirements to be a Qualified Person for the purposes of National Instrument 43-101 and this technical report has been prepared in compliance with National Instrument 43-101 and Form 43-101F1;
6) I, as a Qualified Person, am independent of the issuer as defined in Section 1.5 of National Instrument 43-101;
7) I am the co-author of this report and responsible for Section 20, and parts of Sections ES, 23-26, and accept professional responsibility for those sections of this technical report;
8) I have not had any prior exposure to the subject property;
9) I have read National Instrument 43-101 and confirm that this technical report has been prepared in compliance therewith;
10) SRK Consulting (Canada) Inc. was retained by Trevali Mining Corporation to prepare a technical report, including a Mineral Resource and Mineral Reserve Statement, for the Santander zinc project located in Peru in accordance with National Instrument 43-101 and Form 43-101F1 guidelines. This assignment was completed using CIM Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines and Canadian Securities Administrators' National Instrument 43-101 guidelines. This assignment was completed using the environmental and social requirements applicable at the time in Peru and taking cognisance of good international industry practice as specified in the IFC Performance Standards;
11) I have not received, nor do I expect to receive, any interest, directly or indirectly, in the Halfmile-Stratmat integrated project or securities of Trevali Mining Corporation; and
12) That, as of the effective date of this technical report, to the best of my knowledge, information and belief, this technical report contains all scientific and technical information that is required to be disclosed to make the technical report not misleading.

["signed and sealed"]

Sudbury, Ontario
October 26, 2017

Gary M Poxleitner, PEng (PEO#100015286)
Principal Consultant (Mining)

CERTIFICATE OF QUALIFIED PERSON

To accompany the report entitled *Technical Report on Preliminary Economic Assessment for the Halfmile-Stratmat Massive Sulphide Zinc-Lead-Silver Integrated Project Bathurst, New Brunswick, Canada* dated October 26, 2017 with effective date of October 26, 2017.

I, G. Ross MacFarlane, residing at 208 Queens Quay, Toronto, Ontario do hereby certify that:

1) I am a Senior Associate Metallurgist with the firm of SRK Consulting (Canada) Inc. (SRK) with an office at Suite 1500, 155 University Avenue, Toronto, Ontario, Canada;
2) I am a graduate of Dalhousie University in 1973, I obtained a Bachelor of Engineering in Mining. I have practiced my profession continuously since 1973. Since graduation I have worked in the mining industry which included development, evaluations, and operations of metallurgical plants including base metal concentrators both in Canada and internationally;
3) I am a Professional Engineer registered with the Association of Professional Engineers of Ontario(PEO) with membership number 28062503;
4) I have personally inspected the subject project on November 2nd and 3rd, 2016;
5) I have read the definition of Qualified Person set out in National Instrument 43-101 and certify that by virtue of my education, affiliation to a professional association, and past relevant work experience, I fulfill the requirements to be a Qualified Person for the purposes of National Instrument 43-101 and this technical report has been prepared in compliance with National Instrument 43-101 and Form 43-101F1;
6) I, as a Qualified Person, I am independent of the issuer as defined in Section 1.5 of National Instrument 43-101;
7) I am the co- author of this report and responsible for sections 12 and 16 and accept professional responsibility for those sections of this technical report. I also contributed to the executive summary as well as sections 20, 21, 24, and 25 of the report;
8) I have had no prior involvement with the subject property;
9) I have read National Instrument 43-101 and confirm that this technical report has been prepared in compliance therewith;
10) SRK Consulting (Canada) Inc. was retained by Trevali Mining Corporation to prepare a technical audit of the Halfmile-Stratmat project. In conducting our audit, a gap analysis of project technical data was completed using CIM *Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines* and Canadian Securities Administrators National Instrument 43-101 guidelines. The preceding report is based on a site visit, a review of project files and discussions with Trevali Mining Corporation personnel;
11) I have not received, nor do I expect to receive, any interest, directly or indirectly, in the halfmile-Stratmat Project or securities of [Trevali Mining Corporation; and
12) That, as of the date of this certificate, to the best of my knowledge, information and belief, this technical report contains all scientific and technical information that is required to be disclosed to make the technical report not misleading.

[“signed and sealed”]

Toronto, Ontario
October 26, 2017

G. Ross MacFarlane, PEng (PEO#28062503)
Senior Associate Metallurgist with SRK

CERTIFICATE OF QUALIFIED PERSON

To accompany the report entitled: *Technical Report on Preliminary Economic Assessment for the Halfmile-Stratmat Massive Sulphide Zinc-Lead-Silver Integrated Project Bathurst, New Brunswick, Canada* dated October 26, 2017 with effective date of October 26, 2017.

I, Jeffrey Barrett, residing at 490 Douglas Avenue, Fredericton, New Brunswick, E3A 5T1, do hereby certify that:

1) I am a Geotechnical Engineering Consultant with the firm of Stantec Consulting Ltd. (Stantec) with an office at 845 Prospect Street, Fredericton, New Brunswick, Canada;
2) I graduated from the University of New Brunswick with a BSc in Civil Engineering in 2006, and the University of New Brunswick with a M.Sc. in Geotechnical Engineering in 2009. I have practiced my profession continuously since my graduation in 2006. My relevant experience includes environmental permitting, tailings and waste rock management, and mine closure, in iron ore, base metals, and gold projects.
3) I am a professional Engineer registered with the Association of Professional Engineers and Geoscientists of New Brunswick (#M6890);
4) I have personally inspected the subject project on numerous occasions since 2007, and most recently in October 2013;
5) I have read the definition of Qualified Person set out in National Instrument 43-101 and certify that by virtue of my education, affiliation to a professional association, and past relevant work experience, I fulfill the requirements to be a Qualified Person for the purposes of National Instrument 43-101 and this technical report has been prepared in compliance with National Instrument 43-101 and Form 43-101F1;
6) I, as a Qualified Person, I am independent of the issuer as defined in Section 1.5 of National Instrument 43-101;
7) I am the co-author of this report and responsible for Section 3.3 to 3.5, 19, co-responsible for ES and Section 20, 23-26 and accept professional responsibility for those sections of this technical report;
8) I have been involved in the project since 2013 for closure planning and ongoing permitting;
9) I have read National Instrument 43-101 and confirm that this technical report has been prepared in compliance therewith;
10) Stantec Consulting Ltd. was retained by Trevali Mining Corporation to prepare a the sections noted above for the preliminary economic assessment, being completed by SRK Consulting (Canada) Inc., for the Halfmile-Stratmat integrated project located in New Brunswick, Canada in accordance with National Instrument 43-101 and Form 43-101F1 guidelines. This assignment was completed using CIM Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines and Canadian Securities Administrators' National Instrument 43-101 guidelines;
11) I have not received, nor do I expect to receive, any interest, directly or indirectly, in the Halfmile-Stratmat integrated project or securities of Trevali Mining Corporation; and
12) That, as of the date of this certificate, to the best of my knowledge, information and belief, this technical report contains all scientific and technical information that is required to be disclosed to make the technical report not misleading.

["signed and sealed"]

Fredericton
October 26, 2017

Jeffrey Barrett, MScEng, PEng
Geotechnical Engineer Consultant

CERTIFICATE OF QUALIFIED PERSON

To accompany the report entitled: *Technical Report on Preliminary Economic Assessment for the Halfmile-Stratmat Massive Sulphide Zinc-Lead-Silver Integrated Project Bathurst, New Brunswick, Canada* dated October 26, 2017 with effective date of October 26, 2017.

I, Paul Keller, PEng, do hereby certify that:

1) I am employed as Senior VP, Technical Services at:
   Trevali Mining Corp.
   Suite 1400, 1199 West Hastings St.
   Vancouver, BC, V6E 3T5
   Telephone - 604 488 1661; Fax 604 408 7499
   Email: pkeller@trevali.com
2) I graduated from Laurentian University in 1983 with a degree in Mine Engineering;
3) I am a Professional Engineer registered with Professional Engineers Ontario (PEO #90101775);
4) I have worked as a mining engineer in the mineral resource industry for a total of thirty four years since my graduation from university. My relevant experience for the purpose of this report is:
   a) Thirty four years of mining management, underground and surface mine, mill, civil, environmental engineering at various mine properties in North America as a direct employee and as a consultant.
   b) Direct employee mine supervision, management and engineering for Rio Algom Ltd. Elliot Lake Uranium division, Barrick and Teck Resources Joint Venture property Hemlo, Crowflight Miinerals, DMC Consulting and Trevali Mining Corp.;
5) I have read the definition of Qualified Person set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a Qualified Person for the purposes of NI 43-101;
6) I am a co-author of this report and responsible for Section 17, and parts of Sections ES, 23-26, and accept professional responsibility for those sections of this technical report;
7) I have been involved in the Halfmile and Stratmat projects since May 2011 and conduct regular site visits and data reviews. My most recent visit to site was September 2016;
8) At the effective date of the Technical Report, to the best of my knowledge, information, and belief, the part of the Technical Report that I am responsible for contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading;
9) I am not-independent of the issuer applying all the tests in section 1.5 of the NI 43-101 as I am an employee of Trevali Mining Corporation. Independence is not required under section 5.3 (4) of the NI 43-101;
10) That, as of the date of this certificate, to the best of my knowledge, information and belief, this technical report contains all scientific and technical information that is required to be disclosed to make the technical report not misleading.

["signed and sealed"]
Paul Keller, PEng (PEO#90101775)
Senior VP, Technical Services

Barrie, Ontario
October 26, 2017